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VOL LXVI 23 FEBRUARY 1952 No 1702

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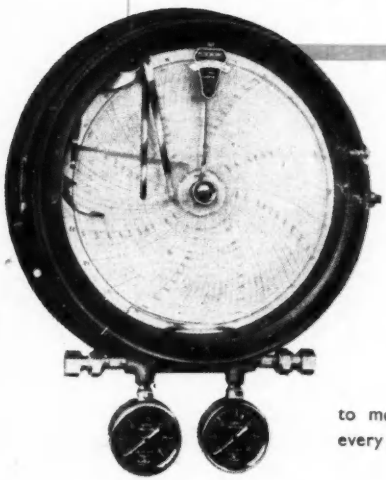

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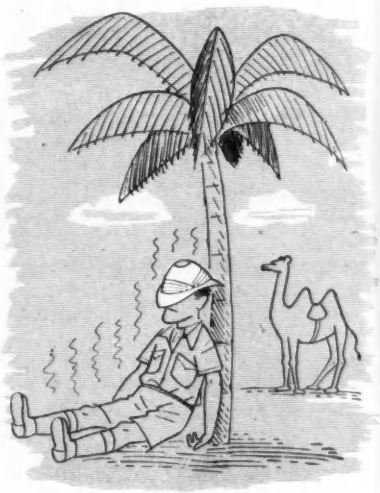

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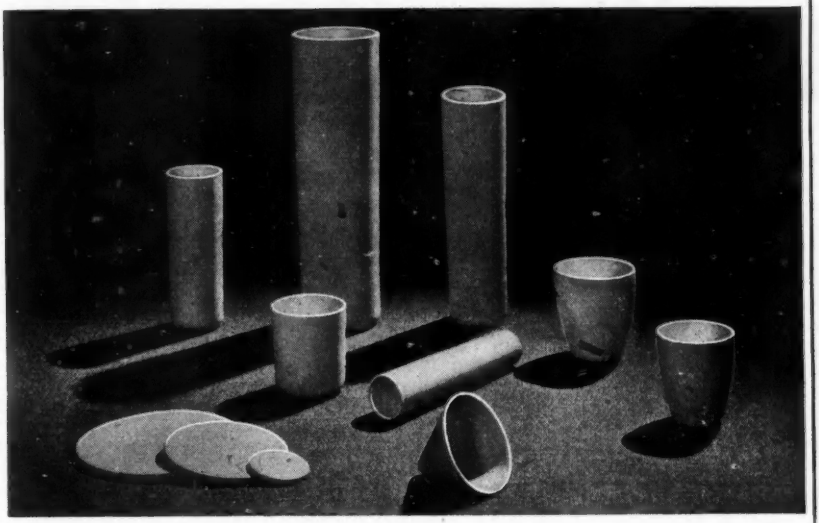

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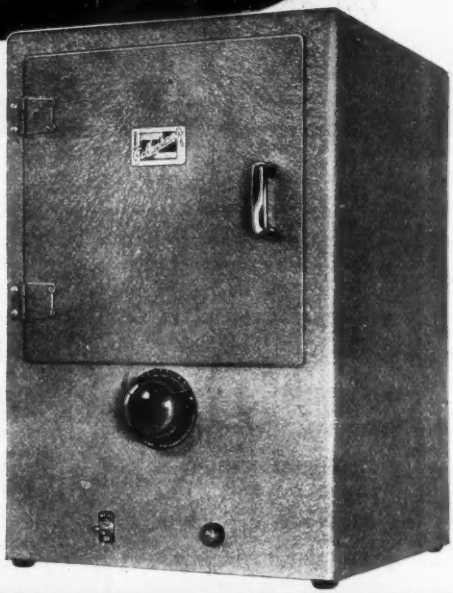

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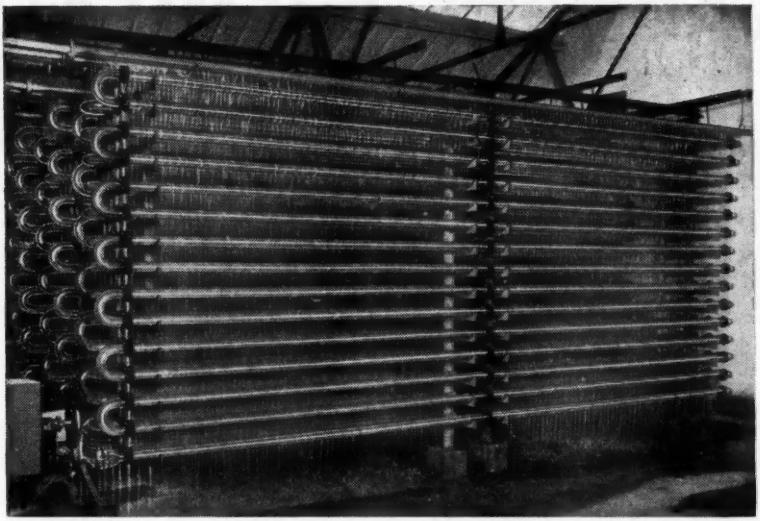

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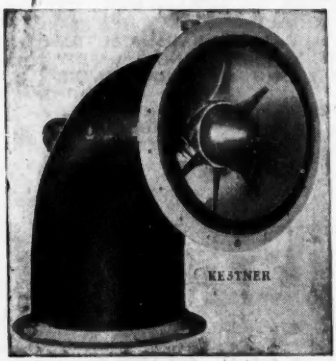

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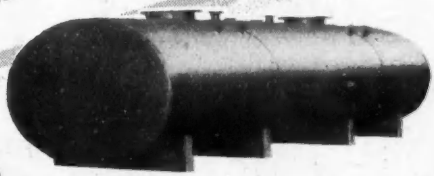

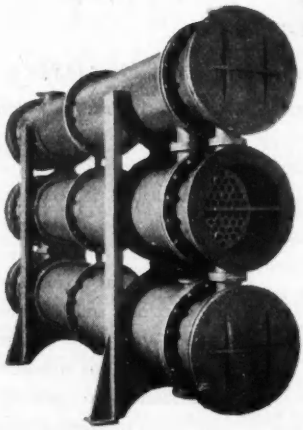

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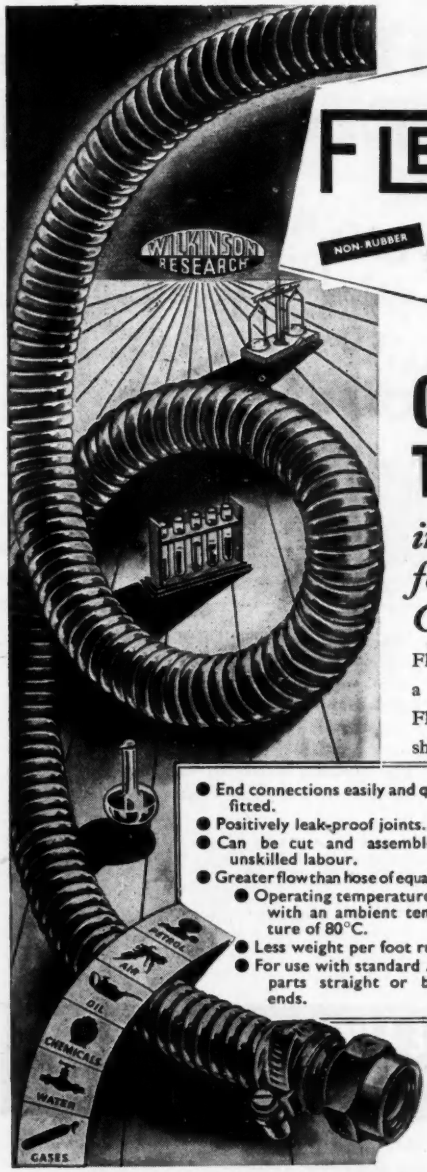

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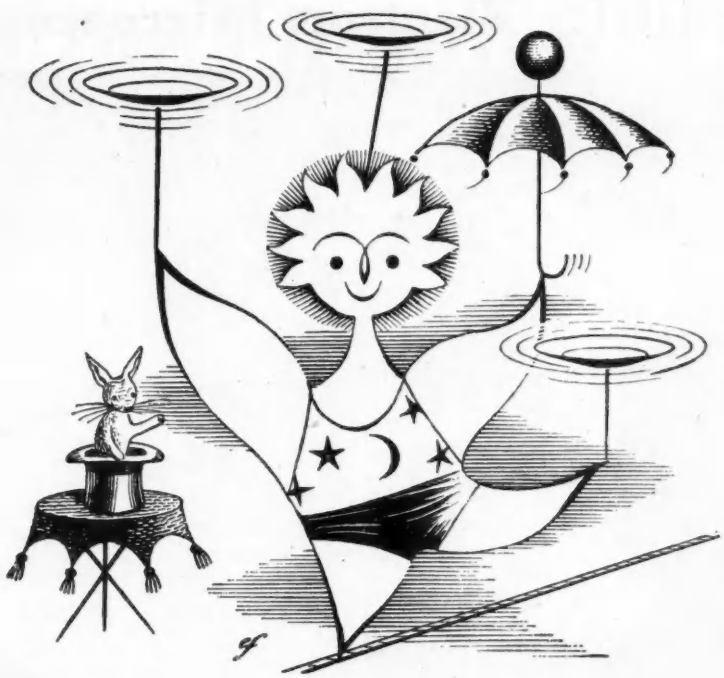

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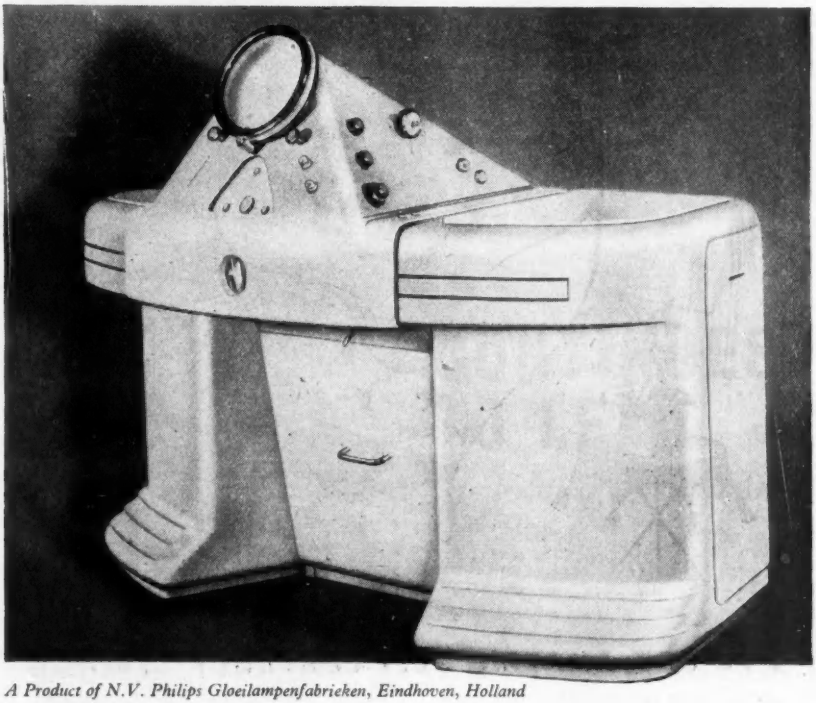

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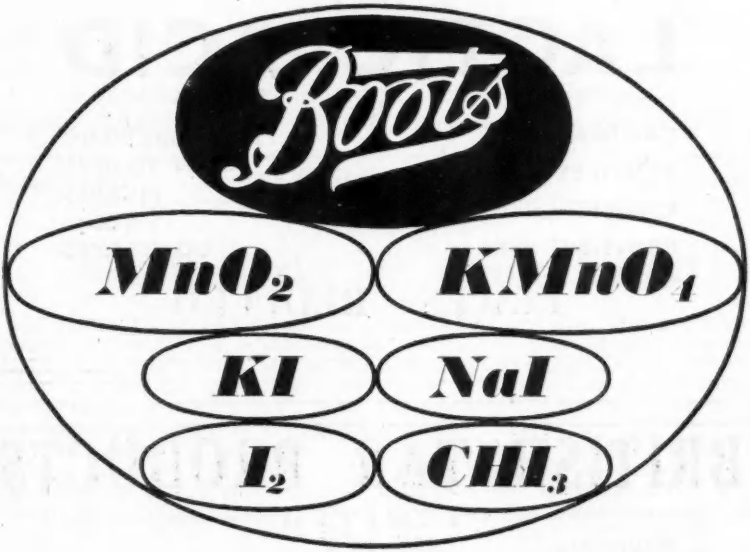

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Volume LXVI 23 February 1952 Number 1702

Food Risks & Chemicals

ANOTHER of the papers read last autumn at the S.C.I. Conference on problems arising from the use of chemicals in food has now been published. Tragically it has become a posthumous paper, for its author, Dr. H. E. Cox, has since died as the result of a road accident; and this severe loss to the profession is only too sharply emphasised by the quality of the paper (*Chemistry and Industry*, 1952, **4**, 72-75). The subject is what many may regard as the most dangerous of all chemical additions to foodstuffs, the use of surface-active chemicals as emulsifiers, fat extenders, flavour or vitamin dispersers, etc. Nothing that Dr. Cox could say in his survey of this subject can be regarded as allaying fears that exist. A large variety of synthetic long-chain organic compounds is available for use in foods. Formerly, and not in any far distant past, only the naturally derived surface-action substances were used, e.g., egg yolk, carbohydrate gums. In a brief period of technological progress, accelerated undoubtedly by shortages of natural substances during the war and post-war years, numbers of the synthetic chemicals have entered the food industry under proprietary names. Most of these names are coined in the modern fashion of attractive brevity and it is reasonable to assume that many users—bakers, ice cream manufacturers, and the like—know them only by these names and judge them entirely upon their performance during food product manufacture.

None of this would be dangerous if there also existed a mass of evidence showing that these substances did not have toxic or deleterious effects upon the human body. But there is a most disturbing absence of such evidence or knowledge. Because most of these synthetic chemicals are composed of organic 'groups' that also occur in natural foods or in substances that are known to be harmless, it seems to have been assumed that they, too, will be 'safe.' Should unknown risks to public health rest upon the always dubious process of argument by analogy? Dr. Cox pointed out that malic acid, naturally occurring in fruit, is harmless, but maleic acid has toxic properties; that glycerol is harmless, but glycol has caused deaths. There is no sure safeguard in this kind of analogy.

It is plausible—and no word more reassuring should be used—to believe that little or no risk is involved when these synthetic surface-active chemicals are used in minute proportions to achieve certain physical properties in food

product mixtures. So long as a suspect substance is (a) used only in small amounts well below any conceivable toxicity level, and (b) known to be regularly expelled by the body and not cumulatively retained, there is a powerful argument to support the use of the substance. That argument ceases to be valid only when some other substance that is freer from suspicion becomes sufficiently and economically available. The whole question of residues from toxic insecticides has to be determined upon that basis of reasoning. Too many people believe that the surface-active synthetics used in food manufacture must be similarly discussed. It is not sufficiently realised that some of these substances are used as fat extenders—a dangerous euphemism for 'fat substitutes'—and when thus employed the amounts incorporated are not describable as small. Compared with the amount of natural fat saved, the amount of synthetic substance may be relatively small; but that is not a fair comparison insofar as human ingestion is concerned. Is enough known about the metabolic behaviour of these modern food additives to take these risks?

Surface-active substances may promote desirable reactions during the preparation of a food. Do we know whether it is desirable for such a substance to promote surface tension reductions inside the body? The natural surface-active agents previously relied upon are quickly digested or changed into simpler substances; at any rate their long record of safe use seems a strong enough argument for that assumption. But for how long does a synthetic substance stay in the body? Its arbitrary length of chain and even its pattern of chain may greatly alter the body's capacity to 'digest' it quickly and without harm. Admittedly, there is no more evidence for these pessimistic suggestions than there is for the easy view that these substances are harmless. But who would think it prudent to walk into a strange, dark room on the assumption that there are no chairs in unexpected places?

The discussion that followed Dr. Cox's paper showed that some chemists still adhere to the opinion that new food additives should not be prohibited until such time as tests had shown them to be harmful, i.e., an additive should be free from restrictions until positive evidence of harmfulness was obtained. This is the crux of the matter. Upon whom must the onus of proof rest? Must a new additive first prove itself to be harmless—or must somebody or some official body prove it to be harmful? Ultimately the State, as interpreter of pubic opinion, must decide where the onus shall be placed. Much, therefore, will depend upon the climate of public opinion. It was not until road deaths and accidents reached alarming heights that a driving test became a vital criterion for holding a driving licence. Doctors had to campaign tirelessly and for many years before legislation ensured that the day would come when only pasteurised or tuberculin-tested milk would be sold.

On Other Pages

The annual subscription to THE CHEMICAL AGE is 35s. Single copies, 9d.; post paid, 1s.: SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3954/5). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited.

Notes & Comments

Conquest of a Weed

A POISONOUS weed that has long prevented thousands of acres of our grassland from carrying cattle has been conquered for the first time—and by a chemical method. Snake pipe or horse tail is a strange wild plant. It absorbs exceptionally high amounts of silica and seems able to flourish on the poorest of soils. It reproduces by spores, like the ferns; and its root system is extensive and tough. Once established in grassland it defies all normal cultivation methods of eradication. Its toxic effects upon cattle seem of two kinds. First, its high silica content—its stems are tough and wiry—is believed to irritate the stomach and lead to severe gastric disorders. Secondly, however, the weed contains at least one alkaloid substance and when cattle graze pastures severely infested with snake pipe they probably consume enough of the weed to set up alkaloid poisoning. Even the milder effect is enough to cause cows to lower their milk yield by 15 to 20 per cent within a few days. Now it looks as if this deadly weed is controllable. If so, many thousands of acres of grassland now looked upon as less than marginal can be brought into the national effort to produce more meat and dairy products. In Somerset alone there are 20,000 acres of snake-pipe-ridden grassland.

The Remedy

THE discovery of a chemical method of control has been jointly made by a farming scientist and one of our leading agricultural chemical companies. Dr. William Plant, research biochemist at Long Ashton, farms 110 acres in Somerset. An important proportion of his moorland grass has been infested with snake pipe for generations. Whenever he is forced to put his Guernsey herd to graze on these infested pastures, their milk yield drops sharply. Even silage taken from the same fields causes a rapid drop in yield when fed. All cultivation methods having failed to expel the weed, Dr. Plant co-operated with Messrs. Plant Protection Ltd., in new tests with MCP (or 'Agroxone') although it has long been considered that chemical weedkillers at best merely destroy or damage the top-growth leaving the root system unaffected. It was found in 1951 that 'Agroxone' at the low rate of 2½ pints per acre achieved complete control over snake pipe. The low rate of application is, strangely enough, the vital influence; for larger rates merely destroy the foliage and leave the root system undamaged. The old forming view that 'snake pipe land is no good' must now be revised.

Before Dalton

IN the current issue of *Endeavour* (1952, **11**, 41) Professor T. S. Wheeler of University College, Dublin, revives one of chemistry's older controversies—should we not credit William Higgins of Ireland for the atomic theory and not John Dalton? Dalton enunciated the atomic theory in 1807 but Higgins, when he was 26 and had only just left Oxford without taking a degree, published a book in 1789 in which a substantial amount of Dalton's later ideas was expressed or indicated. He was the first to use as symbols for elements the first letters in their names, e.g., S for sulphur, I for iron, C for copper, d or D for dephlogisticated air (oxygen), etc. He regarded substances like water and the oxides of sulphur and nitrogen as combinations of these elements—and he attempted to express the forces between elements in compounds by numbers. His book, however, was not intended to put forward a new theory but to attack an old-established one, the phlogiston theory. These notable anticipations of Dalton's ideas passed unheeded and the youthful Higgins plunged into the struggle to make and maintain a living as an eighteenth century chemist.

Some Claim to be First

PROFESSOR WHEELER'S conclusion is exceedingly fair. We certainly need not suspect that Ireland, like other countries in this publicity-conscious

century, seeks to rewrite or re-orientate the facts of history. He contends that Higgins has some claim to be regarded as the 'originator of the chemical atomic theory' though Dalton, 18 years later, expressed it more clearly and fully and in a form acceptable to chemists. On the facts no one can possibly disagree. A compelling diversion in his account of Higgins' early career as chemist is the instruction given (in 1792) by the members of Apothecaries' Hall, Dublin, following Higgins' appointment—'To provide furniture for *the small back room* on the first floor for the use of our Chemist.' *Plus ça change . . .*'

I.C.I.—*Du Pont*

WE have referred previously to the U.S. Government's successful prosecution of I.C.I., Du Pont, and the Remington companies for anti-trust law violations. The final decrees have still to be determined, though it is now known what is being asked by the Government. The joint companies set up by Du Pont and I.C.I. (as in South America and Canada) are to be completely and immediately 'divested'—unless the judge at the decree hearings turns down or tones down this official demand. The method of divestiture is not specified. One company could sell its holding to the other, or the joint companies could be split up into two separate groups each owned by one of the two parent companies; or the joint companies or one of the parent holdings in them could be sold to outsiders. It is reported that the two parent companies are putting forward their own suggestions—that they shall no longer act as agents for products of the joint companies, that they shall not refer inquiries or orders to the joint companies, and that the joint companies be no longer restricted in their rights to compete for trade in the United States. In particular, I.C.I. claim that an American court has no right to interfere with the sale of British products outside the U.S.A.

Royalty-Free Nylon?

ANOTHER aspect of the U.S. Government's likely requirements—the demand for patents to be licensed and for technological 'know-how' to be made available to licensees—has also been clarified. All patents of the companies, existing *or future*, are to be compulsorily licensable subject to a non-discriminatory royalty payment; but for the nylon patents royalty-free licensing is asked for! In addition manuals covering the operative details of such patents are to be supplied and revised every year. Ultimately the Federal District Court will decide the decrees, and there is some feeling—or at any rate there was in New York during January—that the Government's demand for divestiture of the joint companies may succeed to a fairly full extent, but that the requirement of compulsory patent licensing and 'know-how' manual distribution may be considerably reduced.

And Now to Work

THE events of the past two weeks have brought out the best in British journalism. Day by day newspapers everywhere have perfectly reflected the mood of the country; a mood, to be candid, somewhat verging on complacency. In praising rightly a good and great King, we have too often praised ourselves. The first leader in *The Times* on the day before the funeral held the hint of a needed rebuke:

> 'It is a curious fact that the Monarchy, which stands for everything that is old-fashioned and traditional, has shown a greater ability to change and adapt itself than have many younger institutions. There is a great deal in English life that is dangerously rigid and unadaptable. Pride and gratitude for the remarkable tributes that have come from all over the world must be tempered by the knowledge that all tributes necessarily express admiration for what is past. Many do not try to hide their belief that the future must be a decline. Only the British people can prove them wrong.
>
> 'With much against them they have one priceless advantage—the possession of a Monarchy that offends none but unites all and has acquired some of the toughness of time itself.'

THE MIDLANDS SOCIETY FOR ANALYTICAL CHEMISTRY

Panel of Experts Answers Members' Questions

THE annual general meeting of the Midlands Analytical Methods Discussion Group was held recently in Birmingham. Included in the meeting was a discussion by a panel of experts of problems associated with analytical chemistry put by members of the audience.

During the meeting it was unanimously decided to change the name of the Group to the Midlands Society for Analytical Chemistry as it was felt that the time was now ripe for the change of name.

The objects of the Group had been to further the diffusion of knowledge and information connected with analytical chemistry, and the discussion of analytical methods and their application to industry, research, and pure and applied chemistry. Formerly, topics for discussion had been introduced by a short talk by an expert on the particular subject. However, on several occasions, the talk was, indeed, a full lecture, and it was the intention of the Group to have several such lectures each session, as well as the usual talks.

For this reason and also because of the rapid increase in membership it was realised that the Group had now progressed sufficiently to justify the change of name.

Society's Objects Unchanged

The objects of the Society remain the same and it was stressed that membership of the Society is not restricted to Midlands analytical chemists. Anybody interested in the objects of the Society may apply for membership without restriction of age or qualification provided he (or she) is proposed and seconded by two members. Candidates must, of course, be approved by the Committee.

It was also announced that the Committee, with the approval of the Society, has decided to sponsor an international symposium of analytical chemistry to be held in Birmingham immediately following the Oxford Congress in September. Details will be announced at a later date.

The meeting was then opened for the discussion of various analytical problems, and the following is a summary of the questions put and the suggestions offered:—

I. A qualitative test is required for tungsten in a steel containing high chromium, cobalt, manganese and nickel, and also columbium, titanium and vanadium. The steel is only soluble in aqua regia, and it is imperative that the tungsten test take less than one hour. Spectrographic methods are out of the question as the laboratory in question does not possess a spectrograph.

Tungsten Precipitation

It should be possible to precipitate tungsten in Group I. Niobium would also precipitate, but this could be held up by treatment with peroxide.

The following test, due to Miller (1944) should prove of value:—

Dissolve 10 mg. of steel sample in *aqua regia* and a little phosphoric acid. Add 0.2 ml. of concentrated sulphuric acid and fume. Cool, add 1 ml. of concentrated hydrochloric acid and 0.1 g. of stannous chloride. Heat for five minutes at 70°C. Add 0.25 ml. of *iso*amyl acetate and 5 mg. of toluene-3,4-dithiol. Heat on a water-bath for 5-10 minutes at 70°C., with vigorous shaking. Add a few more crystals of the dithiol and heat for a further five minutes. A green colour is formed in the ester layer if tungsten is present. If the layers coalesce, add 0.5 ml. of carbon tetrachloride, shake, centrifuge, and reject the upper layer. Wash the residual layer with concentrated hydrochloric acid. A green colour indicates tungsten. As little as 1 mg. of tungsten (i.e., 0.01 per cent on a 10 mg. sample) may be easily detected.

The stannous chloride reduction is to reduce any molybdenum present to the trivalent stage, and thus prevent its reaction with dithiol. Titanic phosphate, niobium and chromic sulphate will be in solution, but will not interfere.

II. Some difficulty is often encountered in the separation and determination of zinc, especially in the presence of large excesses of other metals such as copper and nickel.

A convenient method of isolating zinc is

by precipitation as insoluble zinc sulphide after removal of the metals of Group I and Group II. Waring (1907) determined zinc in zinc ores gravimetrically as the pyrophosphate, or titrimetrically with ferrocyanide, after separating the metal as the sulphide from a carefully neutralised formate solution.

The classical method involving sodium sulphide separation is not recommended, because it is not sufficiently sensitive and because of interference from nickel and copper. Titration of the zinc with sodium sulphide is also not recommended, because of the lack of sensitivity of the method.

Waring Method

Falls and Miss Ware (1919) carried out an extensive examination of the Waring method, and modified it somewhat. They explained that the difficulties to be met by any method were two-fold:—

(1) The quantitative precipitation of zinc sulphide in a form suitable for rapid filtration and washing.

(2) The subsequent conversion of the zinc sulphide precipitate to a definite compound.

The conditions of precipitation of zinc sulphide used by Walls and Miss Ware furnished results of the highest accuracy. They may be summarised:—

(a) An acid solution of *p*H between 2 and 3 is most favourable for the quantitative precipitation of zinc sulphide in a form suitable for rapid filtration and washing.

(b) The acid concentration is kept within this range by the use of a formic acid—ammonium formate buffer. Citric acid is added to complex any iron and the presence of ammonium sulphate aids in the salting out of the zinc sulphide.

(c) Hydrogen sulphide is passed under pressure at a temperature of 95°-100°C. to obtain a rapid saturation, and to avoid the loss of formic acid by evaporation.

(d) The precipitate is washed with an aqueous solution of 0.1M formic acid saturated with hydrogen sulphide.

The method is applicable to the separation of zinc from iron, manganese and nickel, and to the analysis of zinc alloys as well as zinc ores.

This separation has been applied by Hillebrand and Lundell (1929) to the estimation of zinc in aluminium alloys and by Laws (1941) to the estimation of zinc in magnesium and nickel alloys.

Coleman and Smith (1941) claimed that formic acid is unnecessary and that a mixture of ammonium citrate and citric acid combined the dual function of efficient buffer and iron-complexing reagent. The solution, after the removal of the Group I and Group II metals (including copper), is treated with 6N ammonia until the precipitate of zinc hydroxide just fails to dissolve. 25 ml. of 1M citric acid are added, followed by 6N ammonia until neutral to methyl orange. 50 ml. of 1M citric acid and 25 ml. of 20 per cent ammonium sulphate are then added, the solution diluted to 200 ml., heated almost to boiling, and saturated with hydrogen sulphide. The precipitate is allowed to settle, filtered, and washed with 0.1M citric acid saturated with hydrogen sulphide.

If much cobalt is present, the ammonium sulphate used for salting out the zinc sulphide is replaced with 50 ml. of 20 per cent ammonium thiocyanate solution. This minimises the possibility of post-precipitation of cobalt sulphide. The zinc is then determined by any one of the standard methods. Results obtained are comparable with those obtained using the Waring-Falls-Ware method.

If the precipitation as sulphide is used for trace amounts of zinc, a collector must be used. Copper is satisfactory.

Zinc Reaction

Fischer and Leopoldi (1937) showed that in neutral or weakly alkaline solution, zinc reacts with a solution of dithizone in chloroform or carbon tetrachloride to give a purplish-red solution of the metal complex. If the extraction is carried out at *p*H 4-5.5, the addition of sodium thiosulphate largely prevents interference by copper, mercury, silver, gold, bismuth, lead and cadmium. Addition of potassium cyanide prevents the interferences of nickel and cobalt. This cyanide masking fails with very small amounts of zinc in the presence of large amounts of nickel (e.g., when determining zinc in 'pure' nickel) because the best cyanide available contains appreciable amounts of zinc. The blanks are then several times larger than the amounts of zinc being determined. The *p*H of an aqueous solution of the cyanide, even when concentrated, is too high to permit dithizone extraction of the zinc.

Serfass *et al.* (1949) first remove iron and copper by chloroform extraction of the cupferrates, and then complex the remaining

heavy metals with diethanol dithiocarbamate prior to dithizone extraction of the zinc.

Holland and Ritchie (1939) had previously reported that sodium diethyldithiocarbamate would inhibit the reaction of dithizone with all metals except zinc. Only small amounts of cadmium can be tolerated.

Phillips and Holton (1948) separate zinc from nickel by precipitation with acridine hydrochloride and ammonium thiocyanate [$Zn(CNS)_2(C_{13}H_9NHCNS)_2$] using the corresponding cobalt complex as carrier. Even in the presence of large amounts of nickel, only traces are adsorbed on the zinc-cobalt-acridine complex. The determination is completed by dissolving the precipitate in ammonium chloride solution, separating acridine and any iron present by precipitation with sodium carbonate, and extracting the zinc with a solution of diphenylcarbazone in amyl alcohol. Cobalt interference is prevented by adding hydrogen peroxide (giving cobaltic ions), and a small quantity of cyanide is added to complex the traces of nickel remaining. This method has been adopted as a British Standard Method (B.S. 558, 1951) for the determination of zinc in nickel.

An alcoholic solution of *p*-dimethylaminobenzal-β-naphthiazole methyl iodide has been used as a test for zinc in A.R. nickel salts without any separation (A.R. Standards for Laboratory Chemicals, 1949).

Separation of Zinc

III. The separation of zinc as sulphide in ammoniacal solution gives a fine precipitate, which is slow to settle and difficult to filter and wash without loss occurring. An alternative method is required which will give quantitative recoveries to within ± 0.5 *per cent for amounts of zinc between* 15 *and* 30 *mg.*

It is very seldom that quantitative zinc sulphide separations are carried out in ammoniacal solution, mainly because of the nature of the zinc sulphide precipitate in that medium.

A possible method of obtaining coarse-grained zinc sulphide in ammoniacal solution is by application of the urea hydrolysis procedure of Chan (1932) (cf. Willard and Furman, 1940) who was concerned with the precipitation of calcium oxalate. Calcium oxalate will not precipitate in mineral acid solution, but will in acetic acid or ammoniacal solution. The precipitate normally obtained however, is very finely divided, and does not filter well. If urea is added to a solution containing Ca^{++} and $C_2O_4^{--}$ in hydrochloric acid, and the solution warmed, hydrolysis of the urea occurs with formation of ammonia. The *p*H of the solution thus increases, and a slow precipitation of calcium oxalate eventually takes place. The precipitate is very granular and is easily filtered.

Willard and Tang (1937) precipitated aluminium as the granular basic succinate by a similar procedure.

If the precipitation of zinc sulphide could be effected in acid medium (i.e., in the determination in question), then the method described earlier in this report, in which a formate and/or citrate precipitation medium is used, will definitely provide granular zinc sulphide precipitates.

Easily Filtered Precipitate

Feigl (1924) has shown that if hydrogen sulphide is passed into a weakly acidified solution containing a zinc salt and free iodine, a granular and easily filtered precipitate of zinc sulphide results, instead of the usual slimy gelatinous precipitate. This is due to the coprecipitation of sulphur, with perhaps formation of zinc polysulphide sol (ZnS_2) which will undergo mutual precipitation with excess sulphur sol.

Thioformamide (Gagliardi and Loidl, 1951) and thioacetamide (Flaschka and Jacobljevich, 1950) have been used as sulphide precipitants in place of hydrogen sulphide. More granular sulphide precipitates are obtained.

IV. When using instruments embodying electrical recordings, e.g., Spekker, polarograph, etc., some workers believe that some sensitivity is lost in overcoming the inertia of moving parts. Suitable alternatives, e.g., electronic devices, may be required, to do away with the moving parts.

On the other hand most workers find no reason to believe that any such loss of sensitivity exists. Again, with the Spekker, if the sensitivity is too great, it is found that balancing the galvanometer is extremely difficult.

V. In the estimation of tin in a stannous solution by oxidising to the stannic state, a carbon dioxide atmosphere is generally present. In electroplating solutions cresol sulphonic acid is used as a stabiliser to maintain the stannous state.

It is not known if a satisfactory stabiliser

has been found to replace CO_2 in tin estimations, though information on this question would be of interest.

VI. Certain commercial varieties of asbestos fibre described by the makers as being 'suitable for Gooch crucibles' have proved unsatisfactory. Many workers find, for example, that as much as 15 per cent of the dry weight is lost on ignition. The asbestos is then useless as a filtering medium, since it is no longer fibrous, but granular and friable.

This behaviour indicates that the asbestos in question is hydrated, whereas only non-hydrated asbestos should be used for high temperature work.

Commercial asbestos should carry a guarantee against loss on ignition.

It may be of interest at this stage to quote Kolthoff on the preparation of asbestos filters.

'Some long-fibred soft asbestos of the *non-hydrated* variety should be cut into pieces ½ cm. long and digested on the water-bath for 1 hour with concentrated hydrochloric acid. A good sample of asbestos will then be separated into very small fibres. These should be collected in a funnel on a filter plate, and washed with water until free from chloride. Such washed asbestos can now be purchased from dealers in chemicals' (U.S.A.).

It is not known if commercial houses in this country treat their asbestos in a similar way and/or if they include the hydrated asbestos derived from serpentine in the product.

Tremolite Asbestos Satisfactory

Italian or Tremolite asbestos has generally proved satisfactory for use in ignition work. It is not attacked by acids and is fused with difficulty

M.A.R. asbestos (B.D.H.) has been used with success in combustion processes, and does not visibly alter its structure, even on heating to temperatures above 850°C. It may be that this type of asbestos would solve the problem.

Often asbestos is used where paper pulp could be employed. Again, the sintered glass crucible is invaluable for certain types of filtration, although obviously it cannot be ignited.

Sintered porcelain crucibles, however, are now available in quantity and these can be ignited satisfactorily without alteration in any way of their filtration properties. They can be obtained giving a very close range of particle size. The work of Russell and Harley (1930) is worthy of mention. They recommend the use of silica cotton as a filtering mat in Gooch crucibles. This material does not sinter below 800°C., is resistant to the action of most reagents, and is non-hygroscopic.

These workers carried out a thorough investigation of the relative merits of silica cotton, asbestos and glass cotton, with respect to chemical inertness, retentivity and hygroscopicity. Silica is more chemically inert than the so-called resistance glasses, while asbestos may be appreciably dissolved by acids, alkalis or alkaline phosphates.

Silica cotton possesses good retentivity for precipitates, and its low hygroscopicity is a further advantage over glass cotton and asbestos.

Modifying Plant Growth

CHEMICAL control of plant growth was discussed by Professor R. L. Wain (Wye College, University of London), in a paper delivered to the Yorkshire section of the SCI held in Leeds on 11 February.

A large number of chemicals were now known, said Professor Wain, which could modify the growth of plants when administered in very small amounts. Simple compounds like ethylene were active growth regulators, as were certain substituted benzoic acids. The most important synthetic compounds, however, were either aryl- or aryloxy-alkylcarboxylic acids. Many of these played an important part in crop production for example, as selective weed killers, in plant propagation, for the setting of fruit and for inhibiting the sprouting of buds.

Studies on the relationship between growth-regulating activity and chemical structure in the aryloxy acids had given striking results and had led to a hypothesis on the mode of action of these materials.

An important property of aryloxyalkylcarboxylic acids was that they could be taken up by the roots of plants and distributed throughout the tissues. Certain of these compounds, which on structural grounds could not show growth-regulating properties, had been examined as systemic fungicides. When bean seedlings were allowed to take in such compounds through the roots they acquired a significant protection against certain fungal diseases.

A Review of Phenol Analysis

Part I—Qualitative : Colorimetric (Organic Reagents)

NATURAL sources of many phenols are quite inadequate to meet modern demands, and the production of phenols is, therefore, a major industry. Phenol, thymol and carvacrol are three examples of the inadequacy of natural sources. Again, some phenols do not occur in nature and synthetic methods of preparation are essential.

Methods for the analysis (qualitative and quantitative) of phenols are of great importance to the industrial analytical chemist. Many phenols occur as products of metabolism, and their liberal distribution throughout the animal and vegetable kingdoms is of interest to the biological chemist, as is their use in medicines and antiseptics.

The varied importance of phenolic compounds has led to the development of many methods for their detection and determination. A comprehensive literature exists on the subject, and the purpose of this review is to collect under one title the more important of the analytical methods developed during the past 30 years or so. It is not intended to detail any of the well-known classical procedures for the detection of phenols (e.g., the methods of Liebermann, Millon, etc.).

While the tests to be described in this first part are designed to detect phenols, it is noteworthy that very few of the reactions directly involve the hydroxyl group. Most of the reactions are due to the influence of the phenolic grouping on the remainder of the molecule.

It is unfortunate that only on very few occasions are reaction sensitivities given, so that it is impossible in this review to make a true comparison between reagents.

The methods to be described may be conveniently classed as follows:

1. Colorimetric: (a) Organic, (b) Inorganic.
2. Physico-Chemical.
3. Miscellaneous.

Each class will be considered in turn.

Colorimetric Methods

As expected, the majority of the methods for the detection of phenols may be classed under this heading. Many organic and inorganic methods are available,[1] although more organic than inorganic reagents have been forthcoming during the past several years. It seems probable that this trend will continue, as there is obviously much more scope in the field of organic chemistry for the development of new reagents.

(a) *Organic.* Gsell[1] stated that the ordinary colour reactions for the identification of phenols were unsatisfactory and sought a method of differentiating between them by means of the absorption spectra of their coloured derivatives. He found that only the phthaleins were suitable for this, and, that all the coloured derivatives of phenols with phthaleins gave sharp absorption spectra in alkaline solution. In addition, the difference between homologues was great enough to give a certain differentiation. In his paper, Gsell described the absorption spectra of the phthaleins of 20 phenols.

Means of Identification

Phenols couple with diazonium salts to form azo dyestuffs, and this reaction has been used as a means of identification. Individual phenols can, of course, be identified by means of the characteristic melting points of these compounds, but this procedure is somewhat tedious. Two of several such coupling reactions, which have been used for the general detection of phenols, are due to Moir[2] and Rosenthaler[3]. The former used a solution of *p*-nitro-benzene diazonium chloride as reagent. With phenol itself, a broad absorption band was shown at 494 in the spectroscope, at concentrations of the order of a few parts per million. This band gave a distinction from other substances which gave colours with the reagent. Rosenthaler was concerned with the microchemical detection of all the well-known phenols, and used the same reagent. He did not state, however, whether certain phenols gave precipitates of characteristic colour, nor did he indicate the sensitivities obtained.

Wales[4] emphasised the diagnostic value of the absorption spectrum as a supplement to colour tests. Colour tests for phenols are of little value unless the colours produced are subjected to critical analysis by the spectroscope. *p*-Nitrobenzene diazonium chloride yields azo dyes with as little as 0.5 mg.

of phenols, providing positive identification when solutions in ethanol, acetone or water are used.

Wales recorded as curves the absorption spectra of the azo dyes of a number of phenols in these three solvents, and gave the corresponding colour of the solutions, as well as the absorption spectrum maximum. He was particularly interested in the examination of medicinal preparations, and outlined a method for the detection and identification of small amounts of phenols in such materials.

Sensitive Colour Test

Kondo[5] proposed a sensitive colour test for phenol based on its reaction with the dyestuff Echtrotsalz B (*p*-nitromethoxybenzene diazotate). The test was effected as follows:—

An aqueous chilled solution of the reagent was treated with a little lithium carbonate, and then mixed with the ice-cold solution to be tested. The test was also carried out on the spot plate, but better results were obtained on a microscope slide. As little as 0.02 mg. of phenol could be detected. Other phenols interfere.

A valuable test for the detection of resorcinol in phenol and cresol is based on its reaction with 4-diazophenol-3,5-disulphonic acid[6], in the presence of concentrated aqueous ammonia. A red coloration is obtained if as little as 1 μg. of resorcinol is present in 1 ml. of the phenol.

p-Dimethylaminobenzaldehyde in sulphuric acid is a good colour reagent for phloroglucinol and catechol. Joachimovitz[7] applied the reagent to the microchemical investigation of 464 different plants to determine the distribution of substances giving a colouration with it. He found that the reagent was more rapid in reaction and more localised than the well-known Lindt's reagent.

Sodium *para*-toluenedisulphochloroamide (Chloramine-T) is another useful organic reagent for the detection of phenols. Berthelot and Michel[8] found that it yielded characteristic colours, especially with polyhydroxy phenols. The colours obtained are dependent on the concentration of solutions used, quantity of reagent, nature of solvent, etc., and may be used for the characterisation of individual substances. Thus, resorcinol, catechol and hydroquinone give different colourations, the effects being still noticeable at dilutions of 1 : 10,000, 1 : 50,000 and 1 : 1,000 respectively.

Similar, but less characteristic effects are obtained with *p*-sulphodichloraminobenzoic acid and *p*-toluene sulphodichloroamide.

Aqueous formaldehyde has been used by Rossi[9] to detect various phenols in photographic developers. The developer is dissolved in concentrated sulphuric acid and 10-20 drops of very dilute aqueous formaldehyde are added to the solution, so that the two layers do not mix. A coloured ring is formed at the junction of the two solutions, and, on mixing, a uniform coloration. Hydroquinone gives an abundant yellow precipitate turning brick-red, brown and finally grey, while catechol gives a wine-red ring and the same colour on mixing. *p*-Aminophenol gives no colouration.

Benzoylacrylic acid[10] gives a very orange-red colour with phenol, *o*-, *m*-, and *p*-cresol, thymol, resorcinol, catechol and phloroglucinol. α-Naphthol also gives a stable colour but the β-isomer colouration is unstable. The test is carried out by dissolving a few crystals of the phenol in 1-2 ml. of concentrated sulphuric acid and adding a small quantity of benzoylacrylic acid. The colour is produced in the cold.

Analytical Detection

The reaction of phenols with quinonechlorimides has been utilised for their analytical detection[11]. The test is sensitive to 1 part in 20 million. For quantitative tests, a piece of solid 2,6-dibromoquinonechlorimide, the size of a pea, is shaken with 10 ml. of water to make a yellow suspension. Two or three drops of the suspension are drawn from the middle of the tube and added to the solution to be tested. The latter must be very dilute (1-2 parts of phenol per litre) and must have a *p*H of about 9.4.

By following the maximum colour formation (10-20 min.) with the spectrophotometer, the method can be made quantitative.

Several aldehydic substances give colour reactions with certain phenols. Formaldehyde has already been mentioned, and Ekkert[12], who spent many years investigating the analytical chemistry of phenols, found that amylaldehyde, furfuraldehyde, salicylaldehyde, cinnamaldehyde, vanillin, piperonal, citral and sucrose gave colours on admixture with all the well-known phenols. The tests were carried out by mixing 4 drops of a 1 per cent phenolic solution with 4

drops of 1 per cent ethanol and adding 0.5 ml. of concentrated sulphuric acid.

Ware[13], in a series of papers, used aldehydes, dihydroxyacetone and tartaric acid for the detection and differentiation of phenols. In particular, he examined the reactions with formaldehyde in concentrated sulphuric acid. He carried out certain precipitation and staining tests, and found that when heated in the presence of hydrochloric acid and formaldehyde, certain phenols could actually be separated from others. He also outlined methods for the detection of cresol in carbolic acid, and for distinguishing liquefied *o*-cresol from *m*-cresol, vanillin being used as reagent.

The same worker also described tests for certain phenols in which hydrogen peroxide is used as reagent either alone or in conjunction with formaldehyde or dihydroxyacetone. The tests were applied in sulphuric acid admixture. Specific tests were given by catechol, resorcinol, phloroglucinol, thymol and gallic acid. The simple and convenient tests with hydrogen peroxide alone readily distinguish phenol from the cresols, and phloroglucinol, orcinol and resorcinol from one another.

An aqueous solution of ammonium iodoxybenzoate[14] gives straw-to-garnet colorations with morphine salts which are, of course, phenols. Only apomorphine of the other opium alkaloids gives a colour. The test will distinguish adrenaline from ephedrine, and can be adapted to the detection of phenols and cresols in organic fluids, e.g., when present as preservatives.

Reduction Used

It is well-known that *o*-dinitrobenzene can be reduced to give a deep-violet quinonoid salt. Alkaline solutions of some polyhydroxyphenols will effect this reduction, and the test has been applied for the detection of these phenols[15]. Compounds having two hydroxy groups *ortho* and *para* to each other give a positive reaction, whereas compounds having *meta*-hydroxy groups give a negative reaction. As little as 12 μg. of hydroquinone and catechol in 1 ml. of solution can be detected when the concentrations of dinitrobenzene and alkali (sodium carbonate) are 1 per cent and 25 per cent respectively. The reaction can also be used for the detection of *o*-dinitrobenzene.

m-Dinitrobenzaldehyde gives a pink coloration or turbidity with phenol, and Eegriwe[16] used the reaction for the detection of phenol in the presence of other phenols, which either do not react or give less characteristic colorations. The test is as follows:—Place 1 drop of the aqueous phenol test solution in a test-tube, add a little of the solid reagent and 2 ml. of approximately 63 per cent sulphuric acid. Heat to 65°C. on a water-bath.

Steigmann[17], in a more recent paper, suggested the use of an aqueous solution of the sodium salt of β-naphthaquinone sulphonic acid for the detection of monohydric phenols. In the presence of ammonia, blue or bluish-green colorations are given. *Para*-substituted phenols either do not react or give but a faint reaction.

Test for Polyhydric Phenols

In further work on the detection of phenols, Eegriwe[18] developed some colour tests for polyhydric phenols. Thus, when pyrogallol is allowed to react with phloroglucinol in ammoniacal solution, a violet coloration is obtained which serves to detect as little as 0.5 μg. of the former in 1 drop of test solution.

1,2,4-Trihydroxybenzene may also be detected in less than μg. amounts by the violet colour it gives when heated slightly with solid phthalaldehyde and a little concentrated sulphuric acid, and the solution cooled and diluted. Finally, Eegriwe detected 1 μg. of phloroglucinol in 1 drop of solution by treatment with 2-hydroxy-5-methoxybenzaldehyde. A solution of monoethanolamine molybdate in ethyl alcohol gives a red coloration with *o*-diphenols. Thomas[19] examined the reaction of more than 50 compounds of this type and found that all gave the reaction. Of the more common dihydroxy phenols, catechol gives a test, and may in this way be detected in presence of other phenols such as resorcinol and hydroquinone.

Wurzschmitt[20], in a search for methods of distinguishing *o*-cresol in presence of the *meta*- and *para*-isomers, found that heating with benzaldehyde and 75 per cent sulphuric acid to 140°C. gave such a distinction. A reddish dyestuff was formed, the salts of which were violet or blue-violet in colour. The method was particularly valuable for the detection, and possible determination, of *o*-cresol in technical *o*-tritolyl phosphate in softened artificial products.

The well-known vanillin-sulphuric acid test for rotenone has been used[21] for the general detection of many compounds containing phenolic hydroxy groups. A red colour is obtained, but the reaction is by no means selective.

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New British Standards

Packaging and Pipettes

EXPORTERS of non-metallic materials often have to contend with spoilage of their products resulting from attack by moulds, bacteria, insects, mites or rodents. The avoidance of such attack presents a difficult problem because it is necessary in each instance to consider the compatibility of possible protectives with the article itself and with the material from which the container is made. Moreover, a protective which gives excellent service for one product in a given type of package when it is sent to one area, may break down completely if an identical article in an identical package is sent to an area with different climatic conditions. If at all possible, fungicidal and insecticidal treatment should be given to articles in the course of their manufacture. Packers can, however, assist in avoiding this type of damage if the article cannot be protected during the manufacture, and guidance on the steps they can take to achieve this is contained in a newly published section of the British Standard Packaging Code, B.S. 1133. Copies of the new Section 5, 'Protection against spoilage by micro-organisms, insects, mites and rodents', can be obtained from the British Standards Institution, Sales Department, 24 Victoria Street, London, S.W.1, price 2s., post free.

B.S. 1583—'One-mark bulge pipettes', published in 1950, specified a range of 16 sizes, being those most in demand for general laboratory use. A specification has now been prepared, on similar lines, for automatic pipettes. This specifies eight sizes of pipette from 2 ml. to 100 ml. capacity. It gives full dimensions but, in accordance with current practice in British Standards for laboratory glassware, lists only the essential ones as mandatory, the remainder being given for the guidance of manufacturers. The design includes an overflow cup and a special alternative type is described for work in which the liquid must be kept sterile. It includes standard methods for the determination of capacity and delivery time, and tolerances for both. An appendix gives the sizes of glass tubing recommended for the manufacture of these pipettes. Copies of this standard may be obtained from the British Standards Institution, Sales Department, 24 Victoria Street, London, S.W.1, price 2s., post free.

Human Relations in Industry

WAYS and means of ensuring the greatest efficiency in the use of the country's manpower will be discussed at the 'Human Relations in Industry' Conference to be held by the Ministry of Labour and National Service in London from 18 to 20 March.

The conference will be in the nature of a follow-up to one held in 1948 which became known as the 'Carlton Hotel Conference' and dealt with joint consultation, training and allied subjects.

Subjects to be discussed include:—

Factors affecting the employment of those who want to work—including the older worker and the part-time woman worker; helping workers to make the best use of their capacities; the physical wastage of manpower; management-worker co-operation and the will to work.

Discussions will be held as to the ways in which the use of related techniques can be stimulated, knowledge of them extended, and the practice of them improved.

Further particulars of the conference, which will be held at the headquarters of the Institution of Civil Engineers, may be obtained from the Director of Public Relations, Ministry of Labour and National Service, 8 St. James's Square, London, S.W.1.

Brazil's Industrial Development

Sound Chemical Industry Essential

A PRIORITY programme of economic activities to be encouraged by federal and state governments during the next few years has been drawn up by the Commission for Industrial Development, Brazil. With a view to creating the basis of a sound chemical industry the commission recommends official measures to promote the utilisation of national pyrites for the production of sulphuric acid, and to stimulate the manufacture of synthetic ammonia, barilla, caustic soda and of chemical, vegetable and animal manures.

With the exception of the last two, all these products continue to be imported in increasing quantities, in order to meet the growing demands of agriculture and industry, and represent a heavy drain on Brazil's exchange reserves. Comparing the first eight months of 1950 and 1951, imports of barilla and caustic soda increased by 12,000 and 20,000 tons last year, while imports of superphosphates and unspecified chemical fertilisers were 20,000 and 70,000 tons higher.

Imported Sulphur Drop

Imports of sulphur dropped by 18,000 tons, owing to the restrictions against exports in the United States, and Brazil was obliged to purchase supplies from Chile, Belgium and Italy during the last quarter of the year. As prices in these countries averaged £74 18s., £84 and £95 9s. 5d., respectively, as against £31 11s. for American sulphur, production costs in several industries, already very high, will be further increased.

Brazilian manufacturers of phosphatic fertiliser from national apatites were threatened last year with a shortage of sulphuric acid, required to render calcium phosphate soluble. The use of chloric or nitric acid as a substitute is impracticable in Brazil at present, since the former is not produced on an adequate scale, while the latter must continue to be made from sulphuric acid until synthetic ammonia is manufactured locally, probably in 1953 (THE CHEMICAL AGE, **65**, 126).

Coke-ovens of the National Steelworks at Volta Redonda produced 3,662 tons of sulphate of ammonia in 1950 and are supplying local industries with an increasing volume of raw materials each year. The output in 1950 included the following products and quantities (in gallons unless otherwise stated): Benzole, 478,577; toluol, 131,043; xylol, 29,745; disinfectant oil, 100,980; oil of creosote, 188,831; anthracene oil, 40,823; heavy naphtha, 8,788; naphthalene, 847 tons. Production of naphtha products is now sufficient to meet local requirements and still leave a margin for export.

Increase in Exports

During the first seven months of 1951 Brazil exported 3,681 tons of chemical and pharmaceutical products, as compared with 2,078 tons during the corresponding period of 1950. Latin-American countries are the principal purchasers, but orders were also placed by Portugal, France and Belgium during the latter part of the year.

During the same period the overall volume and value of Brazil's imports of chemical and pharmaceutical products increased by 93,000 tons, worth £12,143,000. Imports of plastic materials and synthetic resins increased by 2,000 tons valued at £696,660.

In addition to fertilisers, insecticides, caustic soda and barilla, the Bank of Brazil is now licensing imports of considerable quantities of bicarbonate of soda and ammonia; calcium chloride; nickel, magnesium and calcium sulphates; hydrosulphite of soda; benzoic, formic, citric and tartaric acids; nitrates of potassium and ammonia; aniline dyes (except certain specified Index Colour numbers); penicillin and other medicinal preparations and pharmaceutical essences.

In December, licences were issued to import the following: plastic materials, £90,200; synthetic resins, £129,663; unspecified plasticisers, £147,932. The following orders were placed in Great Britain: plastic materials, £23,250; synthetic resins, £17,865; unspecified plasticisers, £10,250.

The S. Paulo Syndicate of Synthetic Resins stated recently that the 32 principal manufacturers of raw materials and plastic goods in that city have a floating capital of

£5,600,000, employ 33,380 workers and, in several cases, operate 24 hours per day.

A report on the manufacture of plastic articles in S. Paulo appeared in the January issue of *Brazilian Business*. The most important product in terms of economic necessity, it was stated, is plastic insulation for electric wires and cables. Seven well-organised firms are engaged in this branch of the industry.

De La Rue Plasticos do Brasil, organised in 1946 by Thomas De La Rue, in collaboration with Brazilian investors, occupies a site of 6½ acres, makes wireless cabinets and electrical equipment and uses chiefly phenolics. This company's 850-ton compression-moulding machine is the largest in size and pressure capacity in South America. In addition there are 30 other presses of varying capacity in service. Trol S.A., founded in 1939, has 29 large injection-moulding and five compression-moulding machines in operation.

Acetate and phenolics are imported from Great Britain and the United States; polystyrene and phenol-formaldehyde are now largely produced locally while tenite is imported from U.S.A.

Packaging Course Deferred

THE Fourth Educational Course of Packaging originally intended to be held in March, has been postponed. The organiser, the Institute of Packaging, announces that it will now be held during the five days 19-23 May, inclusive, at Shell-Mex House, Strand, London, W.C.2.

Closing date for nominations is also deferred and a limited number of vacancies still exist. Applications can, therefore, be accepted from industrial firms on behalf of suitable executive staff, but early application is advised, as all previous courses were 'over-subscribed'. At the last course, one 'student' travelled specially from Sweden as there are no courses in packaging on the continent.

Experience has shown that although the courses were at first intended for junior executives, they have, in fact, been attended by senior staff, both by age and experience in packaging. Each course is drafted when the interests of the students are known so that the subject-matter will be relevant to their particular requirements.

Courses are arranged in a manner that gives students information on the manufacture, properties and application of packaging media followed by the experience of a user of those materials (or methods), terminating in an open discussion with the appropriate lecturers present to answer questions. The final day is usually devoted to a visit to the research laboratories of the Printing, Packaging & Allied Trades Research Association, with talks on packaging research and testing. Applications should be sent to the secretary, Institute of Packaging, 20/21 Took's Court, Cursitor Street, E.C.4. Telephone: CHAncery 8484.

Students & Industry

CLOSER co-operation between industry and educational institutions was advocated by Sir Hugh Chance, chairman of Chance Brothers, Ltd., when he addressed a recent conference of the West Midlands Group of the British Association for Commercial and Industrial Education in Birmingham.

Sir Hugh, who was a member of the British team which went to the U.S.A. last year to study education for management, suggested that employers should release workers at all levels for day study, as conscientiously as they had released apprentices.

In America 'sandwich' courses in which students alternately spent six months at college and six in their jobs were carried out at the North Eastern University, Boston. Students were grouped in pairs, and while one was at college, the other worked in industry.

If these courses were developed in Britain, Sir Hugh considered that they could be made more realistic by the students paying a substantial part of their expenses instead of the State. Many Midlands firms could co-operate, continued the speaker, and he believed that students should earn their living as they studied.

Speaking afterwards, Mr. A. Wilson, principal of the Birmingham College of Technology, who had also been a member of the team to visit the U.S.A., said that such courses might be considered when the two branches of the college at Garretts Green and Brooklands Farm were opened.

Exploitation of Inventions

Work of the National Research Development Corporation

A GROWING number of inventions in a wide variety of fields is now held by the National Research Development Corporation at the end of its second year's work. An interesting survey of the corporation's activities during the period 1 July, 1950 to 30 June, 1951, is given, and its present problems and future rôle are discussed, in its second annual report now published by Her Majesty's Stationery Office (price 9d.).

In its first report covering the period ended 30 June, 1950, the arrangements were described which were either completed or were being made at that time for liaison with the numerous sources of invention throughout the country in receipt of money in one form or another from the public purse. Further experience has shown that this important liaison is now working smoothly and harmoniously.

A comprehensive system of communication lines is being progressively established, linking up the work of the corporation with that of the Government Departments, the Agricultural Research Council and the Medical Research Council stations, and the universities and industrial research associations of the United Kingdom.

Adequate Notice

As a result of this, whenever a new device or process originates in some one or other of these many centres (of which a complete list was given in its first annual report), the corporation will obtain adequate notice of it at a date early enough to take the ancillary steps necessary to ensure its development or exploitation in the public interest.

This has been achieved on the part of the corporation without embarrassing scientific workers by any restriction upon publication, while the scientific workers on their side are becoming increasingly aware of the need to avoid prejudicing a nationally advantageous discovery by publication prior to making a patent application. The corporation is consequently increasingly in a position to make every effort to see that inventions, which in themselves might be regarded as trivial, are nevertheless fitted into a more embracing pattern of inventive subject matter by collation of all the communications received by it in a given field.

In one particular field, for example, a number of quite independent and parallel contributions to a technology of great potential importance have reached the corporation and been collated in such a way as to dovetail into one another in a most helpful fashion.

Portfolio of Inventions

The corporation now holds a growing portfolio of inventions, of which the salient features at the date of its present report were:—

Source	U.K. Granted Patents	U.K. Patent Applications
Ministry of Supply ..	177	286
DSIR	69	23
Admiralty	142	100
Ministry of Works ..	17	8
Board of Trade	—	4
Medical Research Council ..	2	7
Agricultural Research Council	1	1
U.K. Universities ..	1	41
Miscellaneous	—	18
	409	488

Total Granted U.K. Patents and Patent Applications : 897

In addition the corporation has acquired, or is in the process of acquiring the benefit of overseas rights in a number of these inventions.

In some cases inventions either issue from laboratories in a form sufficiently mature as to enable industry to adopt them forthwith without modification, or, if development expenditure is required, the invention has been made in the first place in response to so clearly felt a need that private industry is willing to undertake the necessary development expenditure on becoming the corporation's licensee.

The portfolio of 897 patents and patent applications accumulated by the end of the corporation's second year of working might convey a misleading impression unless it were understood that the progress of invention entails a high rate of wastage which will in future years involve abandoning patent applications and granted patents.

In the first place inventions compete with one another both parallel and serial-wise. Any given inventor or group of competing

inventors with a problem to solve may conceive alternative possible solutions simultaneously and patent protection is required often before it is clear which of those solutions is going to be the most promising. Alternatively a sequence of solutions may be conceived, each based upon experienced derived from a preceding invention, so that to-day's inventions may modify the value of yesterday's patent position.

Rights Assigned

Finally it must be remembered that Crown Servants are required to assign to the Crown all the rights in any inventions which they may make falling into any field of Government interest. Such Crown servants retain the right to make a claim upon their departments through the machinery of the Departmental Awards Committee in respect not only of Crown use, but also of commercial use of their inventions. This procedure may involve the Crown in securing patent protection for such inventions in order that the rights of individuals may not be prejudiced by lack of patent cover.

From time to time such protection is sought in somewhat borderline cases and as a result a certain number of rights in patent applications find their way into the corporation's portfolio and these subsequently turn out to be of a minor character. This does not relieve the corporation of the responsibility to try and find licensees in respect of these patents, although it may be suspected at an early stage that they may later have to be abandoned.

In addition to the routine exploitation of a large number of inventions the corporation has a smaller number of individual inventions upon which continuous supervision is necessary at a high level. These include: sundry chemicals; synthetic fibres; biologically active compounds; hydrocarbon synthesis; scientific instruments; and agricultural machinery.

Need for special attention in these cases arises from features of intrinsic importance or complexity, relating either to the technical or the commercial aspects of the respective inventions.

In the technical field the importance may arise from an initial breaking of fresh ground in an unexpected direction, at present but little understood and inadequately explored, so that the corporation must exercise a close watching brief. Other cases have other characteristics such as the need for the provision of substantial development expenditure.

Besides its main function the corporation has also dealt with some matters which it deemed sufficiently close to its terms of reference to justify it taking action in the absence of initiative from other sources.

The corporation assisted in arrangements for the collection and allocation of animal pituitary glands for the manufacture of the adrenocorticotropic hormone (ACTH). Following discussions with the Medical Research Council and the Ministries of Food and Health, the Association of British Chemical Manufacturers and the industrial firms primarily interested, a special Pituitary Gland Allocation Committee was set up with representatives of the corporation providing a chairman and secretarial services.

As a result of this collaborative effort, gland collection from abattoirs has been substantially increased, and contracts for supplies of the hormones are being placed by the Ministry of Health. For the time being all the British-made ACTH thus purchased will be allocated to the Medical Research Council for experimental clinical research work.

Problems with Instruments

Problems connected with scientific instruments brought to the notice of the corporation were that (a) potential users (including medical research laboratories) cannot always readily obtain from the United Kingdom industry certain types of specialised equipment, and that (b) facilities for prototype design, manufacture and testing, prior to reduction to the production stage, are not always readily available.

These problems have been examined in detail and following discussions with representative organisations of the industry and Government Departments, research councils and learned societies concerned, a first step to their solution has been taken by arranging with the British Scientific Instrument Research Association and the Scientific Instrument Manufacturers' Association for the study of individual instrument proposals so that their value can be assessed and recommendations made for their development and exploitation.

A somewhat similar though more complex

problem has been raised by inadequate facilities for producing, for clinical and other tests, small quantities of new chemicals which appear to have uses in medicine or as insecticides or veterinary products. This matter is also being studied by the corporation with the object of finding a solution, but early results are unlikely.

In view of the interest shown in the corporation abroad, particularly by Governmental scientific agencies of the Commonwealth countries, personal contacts were arranged between a member of the corporation and representatives of research and other scientific organisations in Canada, South Africa, India, Pakistan, Australia and New Zealand. Suggestions were made for an interchange of inventive results, and it is proposed to establish a working relationship with the organisations concerned.

A number of private inventors approach the corporation with requests for working capital to enable them to set up in business with a view to selling the embodiment of some invention which has either been fully developed, or needs no development, but which industry or the public is reluctant to buy.

Responsibility for these inventions, few if any, of which would fall within the field covered by any reasonable interpretation of the words 'public interest,' is not accepted by the corporation, but it does endeavour to put the inventor in touch with likely entrepreneurs or possible users.

Corporation's Responsibility

The corporation's responsibility to the private inventor lies along the lines of paying for the development work necessary to give practical embodiment to immature but fertile ideas of a sufficient public importance. This can be best achieved by demonstrating a fully engineered prototype to 'a firm engaged in the industry concerned' and thereby proving that the invention is a sound one.

During the period under review the number of inventions communicated to the corporation totalled 1,317 from the following sources:—Government Departments 752; private sources 442, universities 81; industrial research associations 13; Medical Research Council 11; charitable organisations 2; Agricultural Research Council 1; from the Commonwealth 15.

Experience in administering the corporation's affairs has shown that the work which is being done actually represents a long-term investment in British inventiveness rather than arbitrary support for inventions which have a spectacular career in the short-term future.

For this reason it is expected that development expenditure will be low in the earlier years of the corporation's existence, increasing firstly as the number of inventions with which it is concerned accumulates, and secondly as each individual invention which is sponsored approaches a degre of maturity, where heavier expenditure upon it would be justified by an increasing measure of certainty as to its prospects.

Ammonium Sulphate

Demand Likely to Increase

THE shortage of ammonium sulphate, the least expensive source of nitrogen for agriculture, will not be relieved until more sulphuric acid is made available, according to Mr. Chester Edwards, president of Nitrogen Products, Inc., of New York.

Addressing a recent meeting of the American Coke and Coal Chemicals Institute in Chicago, he said that coke-oven producers of ammonia should have a programme of their own for increasing the nitrogen content of all mixed fertilisers.

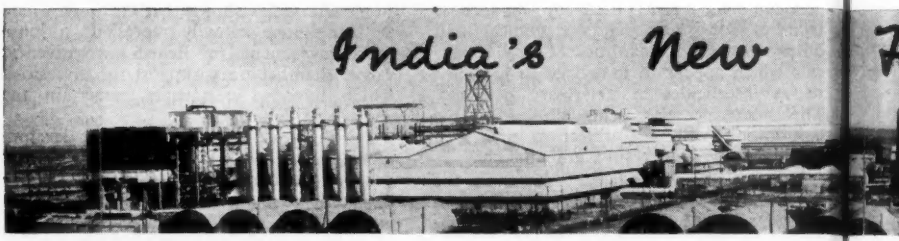
The success of such a programme, he said, would assure that there would always be a demand for coke-oven ammonium sulphate to be used in the manufacture of mixed fertilisers.

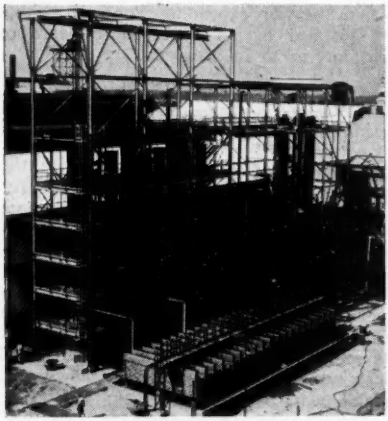
'The accomplishment of this programme will take time', said Mr. Edwards, 'but the demand for fertilisers will increase because the population of the United States and of the whole world is increasing more than at any time in history'.

'Practically all of this increase will come from new synthetic anhydrous ammonia plants and increased capacity at old plants', he continued. 'Both mixed fertiliser manufacturers and producers of ammoniating solutions are working diligently to develop a process that will permit more ammoniating solutions to be used in mixed fertilisers.

'Some success has been obtained by cooling the mixtures as produced but research is under way to develop a catalyst to stop the reversion of superphosphate to an insoluble form when large quantities of these solutions are used'.—B.U.P.

India's New



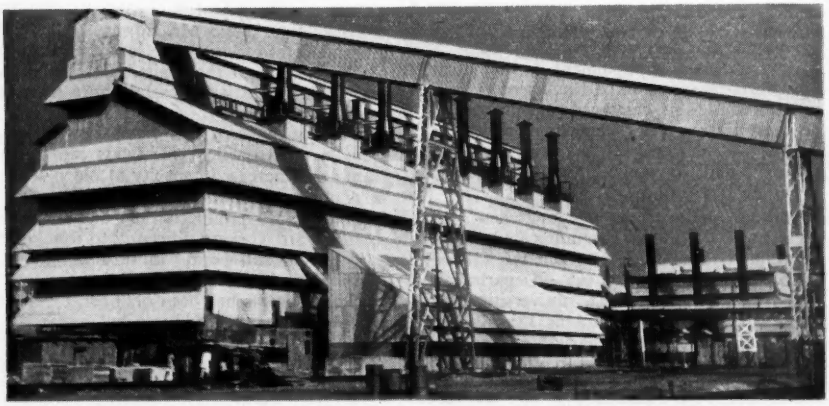


Plant for washing the compressed gases with ammoniacal copper liquor and caustic soda solution

PROMPTED by the need to increase its production of foodstuffs the Government of India invited a technical mission from the United Kingdom to investigate the synthetic nitrogen fertiliser requirements of the country and to report on production of 350,000 tons of ammonium sulphate a year.

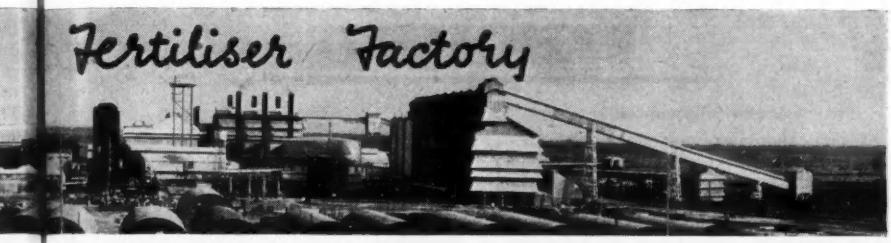
It was recommended that a factory with this capacity should be constructed on the bank of the Damodar river at Sindri.

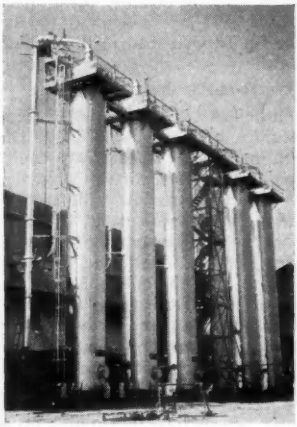
British and American firms collaborated, the organisation, procurement of plant and co-ordination of erection being entrusted to the Power-Gas Corporation, Ltd., of Stockton-on-Tees. Photographs reproduced on these pages are taken from a brochure recently issued by the Corporation. Power-Gas was also allocated a direct contract for the semi-water gas plant.

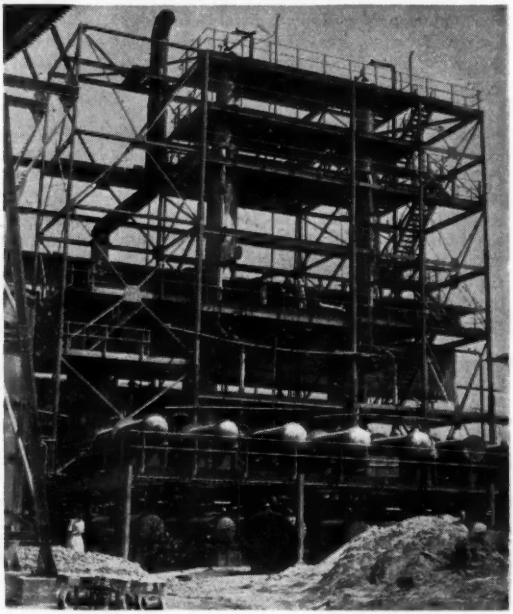


The building in which the semi-water gas plant is accommodated

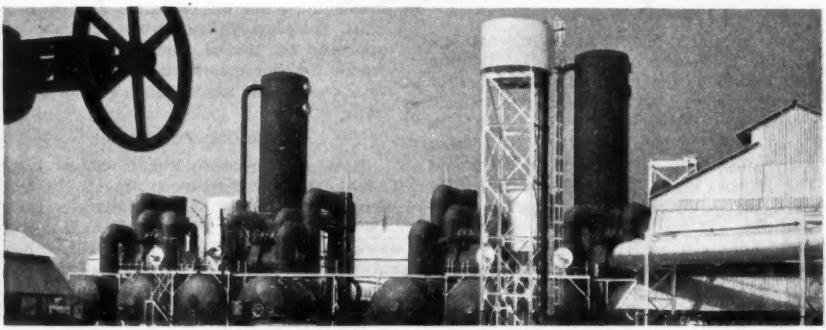
Fertiliser Factory







Six carbon dioxide scrubber towers 75 ft. high wash the stream of converted gas under pressure. Right: In the carbonation section, hydrated ammonia and carbon dioxide gas are brought together



The carbon monoxide conversion plant

HOME

Analytical Symposium

Under the auspices of the Midlands Society for Analytical Chemistry a short symposium on analytical chemistry, dealing with fundamental theory and original methods, will be held at the University of Birmingham on 10, 11 and 12 September, i.e., immediately following the International Congress on Analytical Chemistry at Oxford. Details will be announced later.

Methane Exploration

Application for permission to sink an exploratory bore-hole for natural gas at Fairhead Farm, Grosmont, about six miles from Whitby, has been made to the Whitby Rural District Council by Imperial Chemical Industries, Ltd. Methane, or natural gas, is known to exist in this part of Yorkshire, but it remains to be proved whether there is a sufficient quantity to make its recovery an economic proposition.

Cosmetics and Dermatitis

A lecture on 'Cosmetics and Dermatitis' will be delivered by Dr. E. J. Moynahan, M.R.C.P., at a meeting of the Society of Cosmetic Chemists of Great Britain at 7 p.m. on Friday, 7 March, in the Small Hall of the St. Bride's Institute, Bride Lane, London E.C.4. Dr. Moynahan, a consulting dermatologist, will discuss cosmetics as a cause of dermatitis and also their use in the prevention of the condition. Visitors are welcome.

Science Films from Eleven Countries

Two special programmes of international scientific films will be presented in London next month by the International Committee of the Scientific Film Association, selected from those screened at the Fourth and Fifth Congress of the International Scientific Film Association held at Florence in 1950 and The Hague, 1951. The two shows will be given on the evenings of Thursday and Saturday, 20 and 22 March at 8 p.m. Admission will be by programme, 2s. 6d. each session or 4s. 6d. both sessions, obtainable from the Scientific Film Association, 164 Shaftesbury Avenue, London, W.C., on application.

To Resell Lead

The Ministry of Materials announced recently that with the agreement of the Canadian and Australian Governments and the producers, 30,000 tons of lead supplied under their current contracts with the Ministry have been resold and will be delivered to the United States during the next four months. Prices will be equivalent to the current price for foreign lead in the United States.

Water-in-Alcohol Test

A new and delicate test for water in alcohol has recently been developed by Dr. J. E. C. Stringer, of Vickers-Armstrong, Newcastle-on-Tyne. As reported in *Nature*, the test consists of a chromatograph carried out on blotting paper impregnated with ferrous sulphate and potassium ferricyanide. The first zone that the liquid reaches is the ferrous sulphate. If the alcohol contains water, this salt is carried up to the ferricyanide zone, where a blue coloration of ferric ferrocyanide appears, its strength varying with the amount of water present.

Factory to be Rebuilt

The Clayfield Oil Works of John Haigh & Co., Ltd., oleine manufacturers, Slaithwaite, which were badly damaged by fire last July, are to be rebuilt. There was a similar fire eight years previously, and to reduce the risk of future fires the owners have agreed to the erection of single storey buildings only and at the same time to divide the plant into separate departmental units. Colne Valley Urban Council has approved the use of land adjoining the oil works for the manufacture of oleic and stearic acids and glycerine on certain conditions.

Meeting Postponed

It is announced by the Chemical Engineering Group that its meeting to be held jointly with Plastics and Polymer Group (SCI), has been altered from 29 February to Friday, 7 March. The meeting will be held at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2. in two sessions, morning, 10 a.m. to 12.45 p.m., and afternoon, 2 p.m. to 4.30 p.m.

OVERSEAS

Help from Japan

Australia is importing Japanese steel in an effort to complete the aluminium plant at Bell Bay, Tasmania, in time for production to start by 1954. By then, it is expected Australia's needs will have reached 22,000 tons a year, compared with the 14,000 tons now required. At first bauxite requirements will probably be met from India, but it is planned to draw on domestic deposits as soon as conditions permit.

Argentine Toluene Plant

A plant has been opened, built by the Department of Military Factories at the river port and oil-refining centre of Campana in Buenos Aires Province for making synthetic toluene. It is expected that this will greatly help the progress of the Argentine chemical industry in the production of aromatic hydrocarbons. The plant should serve not only to make war material, but to supply various other important products.

Sausages and Seaweed

A new type of sausage skin made from Norwegian seaweed will shortly appear on the world market, according to a processing factory, A/S Protan, at Drammen, South Norway. The skin is perfectly edible, and is claimed to be 29 times lighter in weight than the cellophane paper generally used today. In Germany a factory is being built to manufacture the new sausage skin at the rate of 22,000,000 yards a month. The manufacturing process is patented in Germany, and is the result of two years of experiments.

New Atom Company

The Canadian Government has announced the setting up of a new organisation, 'Atomic Energy of Canada, Ltd.' to control the country's atomic energy project at Chalk River, Ontario, which is being expanded.

High Grade Pyrites

High grade sulphur-bearing pyrites and vermiculite have been discovered in Cuddapah district and the mica region of Gudur, by Mr. C. S. Ramu, Special Officer for Mines and Minerals, Madras Government. Samples of these minerals have been received and they are believed to be 'superior to any others located so far in India'.

Colombian Chemical Development

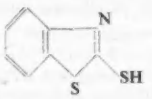
The government plant to manufacture alkaline products was recently inaugurated at Bogota. The factory, which cost the Colombian Treasury U.S. $15,000,000, has an annual capacity of 22,000 tons of barilla, 9,000 tons of caustic soda, and 4,400 tons of bicarbonate of soda. The government now plans to build a salt refinery, with a capacity of 3,000 tons annually.

Du Pont Research Awards

Research awards given by Du Pont for the academic year 1952-3 have just been revealed by the company. These amount to a total sum of $510,000 (£146,428) distributed over 75 post-graduate fellowships at 47 universities and grants-in-aid to 15 universities. There are no strings attached to the grants, apparently, the universities themselves deciding the line of research for which the money shall be used. The only stipulation is that the research shall be fundamental, not commercial.

New Silver Determination

A recent discovery that promises to be of importance in the quantitative determination of silver, is that of Italian research workers, who have found that the metal is precipitated by 2-mercapto-benzthiazole—a rubber vulcanisation accelerator:



The precipitation is done in ammonia solution, and because of the high molecular weight of the reaction product, small amounts of silver can be accurately determined. An added advantage over the chloride determination is that the precipitate is stable to light.

Chemical Fibre Output

The Chemical Fibre Association of Japan has announced that, for the fiscal year commencing 1 April, 1952, the industry will produce 430 million pounds of rayon, stable fibre, strong fibre and acetate fibres.

The Chemist's Bookshelf

STRUCTURAL ADHESIVES. Lange, Maxwell & Springer, Ltd., Neal Street, London. 1951. Pp. VI + 203. 21s.

This book is a collection of lectures given at the summer school held by Aero Research Ltd., at Cambridge, in September, 1951, on the theory and practice of gluing, mainly with synthetic resins. It deals with the fundamental principles of adhesion of wood, rubber, plastics and metals, the application to veneers, plywood manufacture, electrical industry and friction fabrics.

It discusses the chemistry of some synthetic resins, their characteristics, properties and application as adhesives. There are interesting and very practical chapters on tapeless edge splicing of veneers, strip heating, radio-frequency heating and processes used in bonding metals. Many up-to-date methods of testing adhesives are described, which, if published at all, have only appeared in specifications. An echo of the lecture room is found in the enumeration of difficulties occurring in gluing and their remedies, shortening of setting time, extension * (cheapening) and fortification of 'glues' and in many valuable points probably elicited by intelligent questions.

Some prominence is given to 'Redux' a process developed and patented by the organisers of the lectures. By this process a phenol-formaldehyde resin is used in conjunction with a polyvinyl-formal power.

In a collection of lectures of this nature duplication in unavoidable, particularly as many of the students probably had little knowledge of theoretical chemistry and required regular coaching in the fundamentals of the materials employed. The conciseness of the information is a desirable feature due to the same cause. Taken in all, this book forms a bridge between theory and practice of bonding materials which will be particularly welcome, as this part of chemistry and physics is very slow in penetrating into text-books.—S.P.S.

PERCIVAL NORTON JOHNSON. By Donald McDonald. Johnson Matthey and Co., Ltd., London. 1951 Pp. 224. 30s.

The British chemical industry is now old enough to have traditions and several of the larger organisations have recognised this fact by the publication of books dealing with the early history and foundations of their companies. The figures which are so immortalised are more frequently men of business than men of scientific achievement, and these eulogies of private enterprise might have sounded a little strange some few years ago. Today, however, when we only dare to dream of a new industrial revolution as a solution to our economic difficulties, these histories are far more acceptable.

The present volume, though dealing with approximately the same original period is on modest scale and the author has confined himself to a biography of the almost forgotten metallurgist who founded the business of Messrs. Johnson Matthey & Co., Ltd.

The task of the author was by no means an easy one and authentic information on the subject was confined to the files of the Mining Journal, the memoirs of Edward Matthey and the archives of the company itself. It is therefore the more remarkable that he has been able to construct such an interesting and detailed account from such unpromising material. It was not, of course, possible to construct anything but a very tentative picture of his childhood and early life, about which there is as little known as about Shakespeare's, and the biography really begins with Johnson already a man of almost twenty, publishing his first scientific paper.

The main interest of the book, however, is not in the recreation of Johnson as an individual, but in the picture it gives of the mining and metallurgical activities that were carried out in the years before the Great Exhibition. The success of the book is in the completeness and clarity of that picture. —J.R.M.

· PERSONAL ·

The appointment of PROFESSOR A. R. TODD, 44, Professor of Organic Chemistry at Cambridge, as chairman of the Government's Advisory Council on Scientific Policy was announced on Tuesday. He succeeds Sir Henry Tizard 66, who retires next month. The post, which is part-time, is unpaid.

The council of the Institute of Welding has conferred the Sir William J. Larke Medal, highest award of the institute, upon MR. W. S. ATKINS, B.Sc., M.I.C.E., M.Inst.W., for his paper 'Continuous Welded Structures—Abbey Works, Port Talbot'. Mr. Atkins is head of the firm of consulting engineers responsible for the design of the new Abbey Works of the Steel Company of Wales, Ltd., at Port Talbot.

Other papers highly commended by the examiners were those of MR. J. LATIMER on 'Automatic Welding' and MR. A. R. MOSS on 'The Welding of Cast Iron'.

MR. L. E. MASHETER, tyre technical superintendent at Fort Dunlop, has been appointed technical manager of tyre production there under MR. F. G. W. KING, technical director. Mr. Masheter was technical man on the gutta percha plantation of the Telegraph Construction and Maintenance Co., of Greenwich, before going to Dunlop in 1927 in charge of the physical testing of rubber. In 1934 he became manager of the process control division at Fort Dunlop. Early in 1942 he was loaned to the British Raw Materials Mission in Washington where he was a contact officer with the U.S.A. tyre industry in the office of the rubber director.

The James Clayton Prize for 1951, amounting to £1,550, has been awarded by the Institution of Mechanical Engineers to DR. H. ROXBEE COX, chief scientist, Ministry of Fuel and Power, for his contributions to engineering science and practice, particularly in the fields of aeronautics, fuel utilisation and power generation.

Evans Medical Supplies, Ltd., announces that MR. D. D. RIPPARD has been appointed an overseas representative for the Carribean area. MR. R. W. ADAMS, formerly a medical representative in the company's home division and MR. L. V. DUGGAN, a former chemist's representative in the home division, have both joined the overseas division and will be going overseas in due course.

The Council of the Institution of Electrical Engineers on 7 February elected SIR ARTHUR PERCY MORRIS FLEMING and SIR EDWARD APPLETON, F.R.S., to honorary membership.

PROFESSOR ERNEST ORLANDO LAWRENCE, 50-year-old director of the Radiation Laboratory, University of California, receives the Institution's 30th award of the Faraday Medal, for distinguished work in the field of nuclear physics.

Sir Arthur (70) played a big part in the development of a technique for high-vacuum high voltage equipment, and demountable large-power thermionic valves, which helped to make radar possible. He helped to establish the Department of Scientific and Industrial Research.

Sir Edward Appleton (59) is honoured for his 'distinguished work in the field of pure and applied physics and his researches into the characteristics of the ionosphere and the part they play in determining the mode of propagation of radio waves'.

Four appointments in the research and development department of Houdry Process Corporation were announced in Philadelphia on 6 February. MR. J. C. DART was named manager of research and development, with DR. ALEX G. OBLAD as associate manager. DR. G. ALEXANDER MILLS is the new director of research, and MR. THEODORE A. BURTIS, director of development.

Filo Color & Chemical Corp., 202 East 44th Street, New York 17, N.Y., announce that MR. S. C. SCHEUER, the company's president, will visit most Western European countries between 15 February and 1 May. Mr. Scheuer will be interested both in placing his company's products with consumers in these countries and also purchasing raw materials for consumption in the United States.

In addition, one of his major concerns will be the appointment of agents or

distributors in the United Kingdom, France, Belgium, Holland, Western Germany, Italy and Spain for 'Viclite' phosphorescent and fluorescent pigments manufactured by Rhode Island Laboratories, Inc. Filo Color & Chemical Corp. were recently entrusted with the export franchise for these important new pigments.

Obituary

MR. MARCUS WILLIAM ZAMBRA, grandson of Joseph Zambra, joint founder of Negretti & Zambra, London, the instrument manufacturers, and a director of the firm from 1909 until his retirement in 1935, collapsed by the roadside near his home at Seal, near Sevenoaks, Kent, on 13 February, and died immediately.

Mr. Zambra was the last of his name in the firm, but it was decided when he retired that the name, which had been a household word for more than 100 years, should be kept.

GERALD ALLEN HOLLAND, 66, retired president of the chemicals firm of Winn & Holland, Ltd., died suddenly on 23 January at his home in Montreal.

Chromatography

Methods & Applications Described

GROWING importance of chromatography and its promising future were emphasised by Dr. Tudor S. G. Jones in a lecture entitled 'By-ways in Chromatography', delivered to the London and South-Eastern Counties Section of the Royal Institute of Chemistry, at a meeting held at the South-West Essex Technical College last December.

Earliest uses of chromatography were unknown, said Dr. Jones, but as an analytical technique it could be said to have developed from Tswett's separation of the chlorophylls. The original name was still used, in spite of the application of the method to colourless materials and to separations into portions of eluent rather than into adsorbed bands.

A simple analogy of chromatographic action was provided by the distribution of a solute between two solvents, which could be developed further as distribution between a solvent and an adsorbent under the conditions of chromatography. Mathematical treatment of the process was disappointing, and seldom led to any prediction of practical application. The most comprehensive treatment was that of Martin and Synge, who applied the concepts of fractional distillation and found that the efficiency of chromatographic separation might be some 200 times that of fractionation.

Although the techniques of chromatography could vary widely, there were three main types of method: frontal analysis, where the solute was allowed to concentrate from solution at the solvent front; elution analysis, where a pure solvent was used to give further separation, and displacement development, where the addition of a solvent which was strongly adsorbed on the column had the effect of concentrating the bands.

Elution analysis frequently resulted in overlapping bands, but displacement development gave a much cleaner separation and was applicable to much larger quantities of material. It had a much more promising future, and was applicable to ion-exchange separations.

The lecture was illustrated by lantern-slides showing the applications of chromatography to the characterisation of antibiotics and of alkaloids, and the separation of cis- and trans-isomers.

In reply to a large number of questions, Dr. Jones described methods of packing columns, and stated that success depended largely on the nature and particle size of the materials.

Chemical Firm's Deficiency

ALLEGATIONS that its books appeared to be 'worse that useless' were made against Johnson, Miller, Dixon & Co., washing plant and chemical manufacturers, St. Anne's Mills, Kirkstall, by Mr. J. H. Lawton, the registrar, when three partners, George, Joseph and Harold Johnson, appeared at Leeds Bankruptcy Court on 12 February.

A deficiency of only £58 was shown, but the Official Receiver described the statement as chaotic and incorrect and suggested that the real deficiency was nearer £3,000.

Examination was adjourned until May, and the three brothers were ordered to submit an amended statement within 28 days, and were warned of the serious consequences should they fail to do so.

Publications & Announcements

INCREASES in material costs and recent labour awards have necessitated a revision of its prices, it is announced by Sunvic Controls, Ltd. A new price schedule has been issued in accordance with which all goods despatched after 11 February are being invoiced. In the past the company has made adjustment by means of a fixed percentage on all items, but in the new list it has been thought a more equitable arrangement to base prices on current costs. The schedule includes relays and auxiliary equipment; electronic equipment; energy and temperature regulators; and vacuum pumping apparatus.

* * *

A FORTY-EIGHT pages booklet, issued by the Copper Development Association, Kendals Hall, Radlett, Herts., entitled 'Copper: Its Ores, Mining and Extraction' deals as simply as possible with the production of copper from the ore to the stage when it becomes available to industry as copper wire, bars, cakes, billets, ingots and shapes. The booklet contains 36 very instructive illustrations and a map of principal copper mines of the world and a list of 47 previous publications, which are available from the Association free of charge.

* * *

IN view of the ever-increasing use of photography and the new and valuable information which is constantly being made available, Kodak Limited is now publishing a new edition of the 'Kodak' Data Book of Applied Photography. This comprehensive collection is now available to photographers generally. It costs 2½ guineas, and this price includes the 4-volume Data Book current at the time of despatch, and a year's supply of new data sheets, issued each March and September; annual subscription thereafter is 10s. 6d. In the new edition all component data sheets have been revised, out-of-date sheets withdrawn, and new subjects added. The 800 pages of current information have been re-grouped and classified under 20 sections, indicated by thumb-tabbed cards for quick reference. The war-time binders are superseded by attractively designed, loose-leaf binders, sturdily made to stand up to constant handling.

D

RESEARCH and control methods used, and the chemical and physical tests made during the production of its improved polystyrene 'Lustrex', are described and illustrated in its latest brochure just issued by Monsanto Chemicals, Ltd. The moulding process is also explained and the wide range of 'Lustrex' applications is illustrated by a number of well-produced colour plates.

* * *

'SCIENCE News' No. 23 has just been published. It contains articles on cortisone, explaining the supply position and the difference between 'formal' synthesis and 'practical' synthesis; an article on antibiotics and growth; an essay on models of the atomic nucleus and the way in which particles are packed together in it (a far cry from Bohr); articles on the problems of bird orientation, central cerebral processes, concert hall acoustics, and a century of Joule-Thomson experiments. At the end is a research report. All the articles live up to that standard of interest which we have come to expect from this admirable series.

* * *

IMPROVEMENTS and economies in the gathering, transporting and packing of seaweed are necessary in the agar industry of Britain and the Commonwealth if it is to compete with the more scientifically controlled Japanese industry. This is pointed out in the fourth of a series of articles 'Seaweeds in Commerce' by R. H. Kirby, B.Com.(London) in the latest issue of *Colonial Plant and Animal Products* (Vol. 2, No. 2, 1951). The writer gives a survey of the agar industry in Japan, China and the U.S.A. and also reviews its development in Great Britain, Australia and New Zealand. An interesting report is also given by H. T. Islip, B.Sc., F.R.I.C., and W. S. A. Matthews on investigation carried out on *Lippia carviodora* from the Somaliland Protectorate to ascertain its commercial possibilities as a source of volatile oil. The *d*-carvone isolated from the samples was found to compare favourably with that obtained from caraway seed oil. It was considered that the oil obtained should find a market in the United Kingdom for flavouring and perfumery purposes, or as a source of carvone.

'THE SPECTRUM', organ of the Society of British Paint Manufacturers, has been published for 1952. This is the sixth annual edition and it contains, besides lists of officers and members of the Society, articles on the trends of the American paint and surface coating industry and their effects on the British industry; on colour and psychology; several light articles—two of them reprinted from *Punch* (very nice, but why not read then in *Punch*—they are not particularly appropriate, and surely the journal of a society should seek to be an individual, not a re-hash of other magazines); extract from recent decisions affecting industry in the courts, etc. At the end is an assortment of jests and epigrams.

* * *

TEN years have now passed since *Endeavour* was first published by Imperial Chemical Industries, Ltd., and looking through the current issue (Volume XI, No. 41) it is easy to see why this quarterly scientific review (published in English, French, Spanish and German) has, in so short a time, become one of the leading journals of its kind. Among the excellent articles in this volume are: 'Some Recent Advances in Chromatography', by Professor A. W. K. Tiselius, of Uppsala University, winner of the Nobel Prize for chemistry in 1948 and now president of the International Union of Pure and Applied Chemistry; 'Some Aspects of Insecticide Biochemistry', by F. P. W. Winteringham, F.R.I.C.; and 'Fibres from Aromatic Polyesters', by J. R. Whinfield, M.A. The high quality of the illustrations and colour reproductions are well-maintained, particularly in the plates which accompany an article 'Colour Vision: A Retrospect', by W. S. Stiles.

* * *

A REPORT has recently been published by the Factory Department of the Ministry of Labour, of an investigation into the explosion risk which arises when welding, or other operations involving heat, are carried out on drums or tanks which have contained inflammable liquid with a flash point above normal atmospheric temperature. The risk of applying heat to drums and tanks which have contained inflammable liquids have long been known. Section 28(4) of the Factories Act, 1937 and Section 11(4) of the Factories Act 1948 aimed at the elimination of the risk by requiring certain safety precautions to be taken before heat was applied. The need for these precautions was generally appreciated in industry where the liquids in question were of relatively low flash point. Numerous accidents have, however, occurred when the work has been done on drums or tanks which have contained liquids of relatively high flash point. The experiments outlined in the report show that explosions are to be expected under such circumstances due to decomposition of the oil or by formation of oil mists and that the necessary precautions should be taken both in the case of high and low flash point liquid containers. The investigation was carried out by the Joint Fire Research Organisation of the Department of Scientific and Industrial Research and the Fire Offices' Committee, at the request of H.M. Chief Inspector of Factories. The report may be obtained from HMSO or any bookseller (6d.).

* * *

A NEW range of refractory coatings for furnaces, boilers, etc., is being marketed by Corrosion, Ltd., of Southampton, under the name of 'Furnascote'. These high-temperature coatings are said to save fuel—a valuable asset these days—to the extent that if used throughout industry one million tons of coal per year could be saved by their sealing and heat reflective properties. Other advantages claimed for it are increased efficiency through glazing, and easier maintenance of steady temperatures; protection of refractories and the deferring of furnace re-bricking (it can be used on old or new bricks); the prevention of cracking and spalling of refractories; the minimising of the effect of slagging of all types; and protection against abrasion from flying ash and thermal shock. The coatings may be applied by brush or spray. They are claimed to be plastic enough when applied, to expand and contract with the furnace wall, yet able to withstand considerable abrasion even when hot.

* * *

A BOOKLET containing three essays on the subject of increased food production, with special emphasis on grassland, has been issued by the Royal Society of Arts, London These essays were originally published in the Society's *Journal*, Vol. XCIX, 501-11, 931-47, and one of them—'Two systems of farming: one for grassland, the other for arable'—is the Society's 1951 Prize Essay, by R. E. Slade, M.C., D.Sc., F.R.I.C. The booklet is available from the Society (2s.).

Next Week's Events

MONDAY 25 FEBRUARY

Incorporated Plant Engineers

Leeds: University, 7.30 p.m. West and East Yorkshire Branch. Dr. Irvine (Leeds University): 'Further Advances in Metallurgy'.

Institution of the Rubber Industry

Manchester: Engineers' Club, Albert Square, 6.15 p.m. M. Venner: 'The Electron Microscope' (illustrated with films and slides).

TUESDAY 26 FEBRUARY

Society of Instrument Technology, Ltd.

London: Manson House, Portland Place, W.1, 6.30 p.m. W. Fishwick (Edinburgh University); 'Temperature Pocket Lags'.

Incorporated Plant Engineers

London: Royal Society of Arts, John Adam Street, Adelphi, W.C.2, 7 p.m. Joint meeting with the Institute of Welding. E. Fuchs: 'Modern Practice in the Welding of Pipes'.

Northampton Polytechnic

London: St. John Street, E.C.1, 7 p.m. First of a course of evening lectures by G. F. J. Murray on 'Liquid Fuels, their Properties and Utilisation'.

WEDNESDAY 27 FEBRUARY

Royal Society of Arts

London: John Adam Street, Adelphi W.C.2, 2.30 p.m. The Earl of Halsbury (managing director, NRDC): 'The Work of the National Research Development Corporation'. Sir Henry Dale, O.M., will preside.

Royal Statistical Society

Birmingham: Chamber of Commerce, 95 New Street, 6.45 p.m. Industrial Applications Section. Birmingham Group. Dr. H. O. Hartley: 'Short Cut Analysis of Variance Based on Range'.

Manchester Literary and Philosophical Society

Manchester: Portico Library, Mosley Street, 5.45 p.m. Chemical Section. Dr. T. G. Halsall (Manchester University): 'Some Recent Developments in Chemotherapeutics'.

THURSDAY 28 FEBRUARY

Society of Chemical Industry

Leeds: University, 7 p.m., with Leeds University Chemical Engineering Society. Hodsman Memorial Lecture, by Dr. A. C. Monkhouse.

Royal Institute of Chemistry

London: South-East Essex Technical College, Longbridge Road, Dagenham, 6.30 p.m. Film Display.

Fertiliser Society

London: Burlington House, Piccadilly, W.1, 2.30 p.m. Dr. E. M. Crowther: 'American Fertiliser Practices and Problems'.

The Chemical Society

Aberdeen: Marischal College, 7.30 p.m. Joint meeting with RIC and SCI. Dr. H. Baines: 'Photography as a Scientific Implement'.

Dundee: University College, 5.15 p.m. Professor E. L. Hirst: 'Structural Relationships in the Hemicellulose Group'.

Manchester: University, 6.30 p.m. Centenary Lecture. Professor T. Reichstein, Basle (Honorary Fellow): 'The Chemistry of the Cardiac Glycosides'.

The Royal Society

London: Burlington House, Piccadilly, W.1, 4.30 p.m. E. Bradbury and C. Martin: 'The Effect of the Temperature of Preparation on the Mechanical Properties and Structures of Gelatine Films'; D. K. Ashpole: 'The Moisture Relations of Textile Fibres at High Humidities'.

Royal Statistical Society

Sheffield: Grand Hotel, 6.30 p.m. Industrial Applications Section, Sheffield Group. N. L. Franklin: 'The Use of Experimental Designs in University Technological Research'.

Institute of Metals

Birmingham: James Watt Memorial Institute, Great Charles Street, 7 p.m. Professor C. S. Barrett: 'Metallurgical Research in the U.S.A.'

FRIDAY 29 FEBRUARY

The Chemical Society

Glasgow: University, 7.15 p.m. Reading of original papers.

Institute of Metal Finishing

Sheffield: Grand Hotel. Dr. S. Wernick: 'Silver Plating—Present Problems and Future Developments'.

Institute of Metals

Birmingham: College of Technology, 10.30 a.m. One-day symposium on 'New Tech-

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Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

HENRY H. BUTTERFIELD, LTD., Watford, chemical manufacturers, etc. (M., 23/2/52). 16 January, £6,000 charge, to Films & Equipments, Ltd.; charged on land and buildings thereon at High Street, Watford. *Nil. 17 March, 1951.

LABORATORY SUPPLIERS, LTD., London, W. (M., 23/2/52). 18 January, mortgage and charge, to National Provincial Bank, Ltd., securing all moneys due or to become due to the bank; general charge. *Nil. 11 March, 1950.

Receiverships

Leslie Lavy, Crystal Chemical Co. (Lee Green), Ltd., ceased to act as receiver on 10 January, 1952.

H. L. Barlow, was appointed receiver and manager, Fertiliser Compounders, Ltd., on 28 January, 1952, under powers contained in debenture dated 27 February, 1951.

New Registrations

Tride, Ltd.

Private company. (504,371). Capital £100. Manufacturers of all kinds of chemical preparations; analytical and research chemists, etc. Directors: H. Holmes and E. Holmes. Reg. office: 192 Windsor Lane, Burnham, Slough, Bucks.

Company News

Borax Consolidated, Ltd.

Net profit of Borax Consolidated, Ltd., after taxation was £791,391 in 1951, compared with £651,601 in the previous year. In 1950, on an issued capital of £1,500,000, the final dividend on deferred ordinary stock was 12½ per cent with a bonus of 2½ per cent. At a meeting of the board held on 12 February it was recommended that for the year ended 30 September, 1951, on issued capital of £3,000,000 a final dividend of 5½ per cent should be paid, with a bonus of 2½ per cent, making a total for the year of 10 per cent.

Imperial Chemical Industries, Ltd.

A prospectus in connection with its issue of 10,093,023 new £1 ordinary shares at 40s. 6d. has now been issued by Imperial Chemical Industries, Ltd. The new shares, as previously announced, will be paid for by two instalments, the first of 20s. a share on or before 7 March, 1952, and the second on or before 18 April, 1952. The new shares will carry full dividend rights as from 1 January, 1952.

In this connection it is interesting to note that the board intends that for 1952 and the following years the interim dividend should represent a greater proportion of the total annual distribution than hitherto.

Although the company's audited accounts for the year to 31 December, 1951, are not yet available, preliminary figures indicate that the amount of the net income for 1951 before taxation exceeds the corresponding amount for 1950.

At 30 September, 1951, the future capital expenditure on new projects authorised by the board amounted to approximately £77,000,000, and since then further expansions of production capacities have been agreed.

Next Week's Events

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niques of Metallurgical Research'. Opening address by Professor A. G. Quarrell.

SATURDAY 1 MARCH

Royal Institute of Chemistry

London: Caxton Hall, Westminster, S.W.1, 7.30-11.45 p.m. London and South-Eastern Counties Section with the London Section, SCI. Buffet dance in aid of the Benevolent Fund (RIC) and Hospitality Fund (SCI).

British Chemical Prices

LONDON.—The industrial chemicals market has been without any special feature and movements in the aggregate have been about the average for recent weeks. Price changes where they have occurred have been to higher levels and the undertone is firm generally. Export business has continued on a good scale with the bulk of the inquiry from Empire countries. Brisk trading conditions have been maintained in the coal tar products market with most sections having little to offer for spot delivery. Creosote oil is in strong demand both for home and export account, while the home demand for cresylic acid is substantial.

MANCHESTER.—Deliveries of chemicals to the textile trades, including the cotton and rayon sections, are on a reduced scale, but otherwise business on the Manchester market during the past week has been on steady lines both on home and export accounts. The alkalis, as well as the potash and ammonia products, are meeting with a good demand, and there has been a fair number of fresh inquiries for the barium compounds and a wide range of miscellaneous chemicals. Prices generally remain on a very firm basis. There is a fair movement of supplies of fertiliser materials with a steady demand reported for most of the light and heavy tar products.

GLASGOW.—There was no falling off in demand during the past week, despite the fact that it is common knowledge that certain sections of the consuming trade are quiet. The majority of manufacturers report that production and sales are very satisfactory. As far as can be ascertained, there are no outstanding changes with regard to export. A steady flow of inquiries are coming through and it would appear that a fair proportion of orders are being received.

General Chemicals

Acetic Acid.—Per ton : 80% technical, 1 ton, £110 ; 80% pure, 1 ton, £116 ; commercial glacial 1 ton, £130 ; delivered buyers' premises in returnable barrels ; in glass carboys, £7 ; demijohns, £11 extra.

Acetic Anhydride.—Ton lots d/d, £166 per ton.

Acetone.—Small lots : 5 gal. drums, £145 per ton ; 10 gal. drums, £135 per ton. In 40/50 gal. drums less than 1 ton, £115 per ton ; 1 to 9 tons, £114 per ton ; 10 to 49 tons, to £113 per ton ; 50 tons and over, £112 per ton.

Alcohol, Industrial Absolute.—50,000 gal. lots, d/d, 4s. 7½d. per proof gallon ; 5000 gal. lots, d/d, 4s. 8½d. per proof gal.

Alcohol, Diacetone.—Small lots : 5 gal. drums, £188 per ton ; 10 gal. drums, £183 per ton. In 40/45 gal. drums : less-than 1 ton, £174 per ton ; 1 to 9 tons, £173 per ton ; 10 to 50 tons, £172 per ton ; 50 to 100 tons, £171 per ton ; 100 tons and over, £170 per ton.

Alum.—Loose lump, £17 per ton, f.o.r. MANCHESTER : Ground, £17 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER : £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—2 cwt. non-returnable drums ; 1 ton lots £47 per ton.

Ammonium Chloride. — Grey galvanising, £27 10s. per ton, in casks, ex wharf. Fine white 98%, £21 10s. to £22 10s. per ton. See also Salammoniac.

Ammonium Nitrate.—D/d, £18 to £20 per ton.

Ammonium Persulphate. — MANCHESTER : £6 2s. 6d. per cwt. d/d.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £93 and £91 10s. per ton.

Antimony Sulphide.—Golden, d/d in 5 cwt. lots as to grade, etc., 2s. 6½d. to 3s. 7½d. per lb. Crimson, 4s. to 5s. 4½d. per lb.

Arsenic.—Per ton, £59 10s. nominal, ex store.

Barium Carbonate.—Precip., d/d ; 2-ton lots, £35 5s. per ton, bag packing.

Barium Chloride.—£44 10s. 2 ton lots d/d bags.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £41 per ton d/d ; 2-ton lots, £41 5s. per ton d/d.

Bleaching Powder.—£19 10s. per ton in casks (1 ton lots).

Borax.—Per ton for ton lots, in free 140-lb. bags, carriage paid: Anhydrous, £59 10s.; in 1-cwt. bags; commercial, granular, £38 10s.; crystal, £42; powder, £43; extra fine powder, £44; B.P., granular, £48 10s.; crystal, £51; powder, £52; extra fine powder £53.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granular, £68; crystal, £76; powder, £73 10s.; extra fine powder, £75 10s.; B.P., granular, £81; crystal, £88; powder, £85 10s.; extra fine powder, £87 10s.

Butyl Acetate BSS.—£263 per ton, in 10-ton lots.

Butyl Alcohol BSS.—£250 per ton, in 10-ton lots.

Calcium Chloride.—70/72% solid £9 12s. 6d. per ton, in 4-ton lots.

Charcoal, Lump.—£26 to £28 per ton, ex wharf. Granulated, £35 to £40 per ton.

Chlorine, Liquid.—£28 10s. per ton d/d in 16/17-cwt. drums (3-drum lots).

Chrometan.—Crystals, 6d. per lb.

Chromic Acid.—2s. 0½d. to 2s. 0¾d. per lb., less 2½%, d/d U.K.

Citric Acid.—1 cwt. lots, 218s. cwt. 5 cwt lots, 213s. cwt.

Cobalt Oxide.—Black, delivered, 13s. per lb.

Copper Carbonate.—MANCHESTER: 2s. 6d. per lb.

Copper Chloride.—(63%), d/d, 2s. 9d. per lb.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Nitrate.—(63%), d/d, 2s. 8d. per lb.

Copper Sulphate.—£107 17s. 6d. per ton f.o.b., less 2%, in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., about £12 12s. d/d.

Ethyl Acetate.—10 tons and upwards, d/d, £174 per ton.

Formaldehyde.—£33 15s. per ton in casks, according to quantity, d/d.

Formic Acid.—85%, £82 5s. in 4-ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1,260 s.g. £14 19s. per cwt.
Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 3d. to 2s. 6d. per lb.; bulk carriage paid.

Hydrochloric Acid.—Spot, 9s. 6d. to 10s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—27.5% wt. £124 10s. per ton. 35% wt. £156 per ton d/d. Carboys extra and returnable.

Iodine.—Resublimed B.P., 21s. 3d. per lb. in cwt. lots.

Iodoform.—25s. 4d. per lb. in cwt. lots.

Iron Sulphate.—f.o.r. works, £3 15s. to £4 5s. per ton. Bags free.

Lactic Acid.—Pale tech., 44 per cent by weight £120 per ton; dark tech., 44 per cent by weight £100 per ton ex works; Usual container terms.

Lead Acetate.—White: £194 10s. per ton.

Lead Carbonate.—Nominal.

Lead Nitrate.—£154 2s. 6d. per ton.

Lead, Red.—Basis prices per ton: Genuine dry red lead, £189 10s.; orange lead, £201 10s. Ground in oil: red, £212; orange, £224.

Lead, White.—Basis prices: Dry English, in 8-cwt. casks, £196 10s. per ton. Ground in oil: English, under 2 tons, £214.

Lime Acetate.—Brown, ton lots, d/d, £30 to £34 per ton; grey, 80-82%, ton lots, d/d, £34 to £39 per ton.

Litharge.—£189 per ton.

Lithium Carbonate.—9s. per lb. net.

Magnesite.—Calcined, in bags, ex works, £27.

Magnesium Carbonate.—Light, commercial, d/d, £87 15s.; cwt. lots £97 10s. per ton d/d.

Magnesium Chloride.—Solid (ex wharf), £15 per ton.

Magnesium Oxide.—Light, commercial, d/d, £221; cwt. lots £227 10s. per ton d/d.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—20s. 1d. per. lb. in 28 lb. lots; smaller quantities dearer.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methanol.—Pure synthetic, d/d, £28 to £38 per ton.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 7s. 10d. per gal.; pyridinised 64° O.P. 100 gal., 7s. 11½d. per gal.

Nickel Sulphate.—Deld. buyers U.K. £140 10s. per ton.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—About £181 per ton, packed in 5-cwt. lots, packed in free 5-cwt. casks.

Paraffin Wax.—Minimum 1-ton lots £76 5s.; smaller quantities £77.

Phosphoric Acid.—Technical (S.G. 1.500), ton lots, carriage paid, £71 10s. per ton; B.P. (S.G. 1.750), ton lots, carriage paid, 1s. 3½d. per lb.

Potash, Caustic.—Solid, £98 10s. per ton for 1-ton lots; Liquid, £37 15s.

Potassium Bichromate.—Crystals and granular, 11½d. per lb.; ground, 1s. 0½d. per lb., standard quantities.

Potassium Carbonate.—Calcined, 98/100%, £116 per ton for 1-ton lots, ex store.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Chloride.—Industrial, 96%, 6-ton lots, £35 per ton.

Potassium Iodide.—B.P., 18s. 7d. per lb. in 28 lb. lots.

Potassium Nitrate.—Small granular crystals, 81s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 7½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 6½d. per lb.; technical, £8 3s. per cwt.; for 5 cwt. lots.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—Dog-tooth crystals, £72 10s. per ton; medium, £67 10s. per ton; fine white crystals, £21 10s. to £22 10s. per ton, in casks.

Salicylic Acid. — MANCHESTER: Technical 2s. 7d. to 2s. 10d. per lb. d/d.

Soda Ash.—58% ex depôt or d/d, London station, £8 17s. 3d. to £10 14s. 6d. per ton.

Soda, Caustic.—Solid 76/77%; spot, £21 12s. 6d. per ton d/d. (4 ton lots).

Sodium Acetate.—£85 to £91 per ton d/d.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 9¾d. per lb.; anhydrous, 11¼d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite.—Powder, 60/62%, £40 per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2-cwt. free bags.

Sodium Chlorate.—£87 to £95 per ton.

Sodium Cyanide.—100% basis, 8d. to 9d. per lb.

Sodium Fluoride.—D/d, £4 10s. per cwt.

Sodium Hyposulphite.—Pea crystals £28 a ton; commercial, 1-ton lots, £26 per ton carriage paid.

Sodium Iodide.—B.P., 20s. 1d. per lb., in 28 lb. lots.

Sodium Metaphosphate (Calgon).—Flaked, loose in metal drums, £123 ton.

Sodium Metasilicate.—£22 15s. per ton, d/d U.K. in ton lots.

Sodium Nitrate.—Chilean Industrial, 97-98%, 6-ton lots, d/d station, £30 15s. per ton.

Sodium Nitrite.—£31 for 1 ton lots.

Sodium Percarbonate.—12½% available oxygen, £8 8s. 4½d. per cwt. in 1-cwt. drums.

Sodium Phosphate.—Per ton d/d for ton lots: Di-sodium, crystalline, £37 10s., anhydrous, £78 10s.; tri-sodium, crystalline, £39 10s., anhydrous, £75 10s.

Sodium Prussiate.—10d. to 10½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Silicofluoride.—Ex store, nominal.

Sodium Sulphate (Glauber's Salt).—£8 per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. £6 per ton d/d station in bulk. MANCHESTER: £6 10s. per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot. £30 per ton, d/d, in drums; broken, £30 15s. per ton, d/d, in drums.

Sodium Sulphite.—Anhydrous, £59 per ton; pea crystals, £37 12s. 6d. per ton d/d station in kegs; commercial, £23 7s. 6d. per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £25 18s. 6d. to £28 8s. according to fineness.

Tartaric Acid.—Per cwt.: 10 cwt. or more, £15 10s.

Tin Oxide.—1-cwt. lots d/d £25 10s. (Nominal.)

Titanium Oxide.—Comm., ton lots, d/d (56-lb./112 lb. bags), £125 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d; white seal, £207 10s.; green seal, £206 10s.; red seal, £205.

Zinc Sulphate.—Nominal.

Rubber Chemicals

Antimony Sulphide.—Golden, 2s. 6½d. to 3s. 7½d. per lb. Crimson, 4s. to 5s. 4½d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Off colour, ex store. Imported £13 10s per ton. Extra white bleached ex store, £16 10s.

Cadmium Sulphide.—About 20s. per lb.

Carbon Bisulphide.—£65 5s. per ton, according to quality.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£69 10s. per ton.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 1s. 9½d. to 2s. 3d. per lb. ; dark, 1s. 8½d. to 2s. 1½d. per lb.

Lithopone.—30%, £77 per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, 'Rupron.'—£20 per ton.

Sulphur Chloride.—British 48s. 6d. per cwt.; Imported £120 per ton.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, £15 12s.

Compound Fertilisers.—Per ton in 6 ton lots, d/d farmer's nearest station, I.C.I. Special No. 1, £26 9s. 6d.

'Nitro-Chalk.'—£12 9s. 6d. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean agricultural for 6-ton lots d/d nearest station, £30 15s. per ton.

Coal-Tar Products

Benzole.—Per gal, ex works : 90's, 3s. 8½d. ; pure, 3s. 11½d. ; nitration grade, 4s. 2½d.

Carbolic Acid.—Crystals, 1s. 6d. to 1s. 8d. per lb. Crude, 60's, 8s. MANCHESTER : Crystals, 1s. 6d. to 1s. 8d. per lb., d/d crude, 5s. 9d., naked, at works.

Creosote.—Home trade, 10d. to 1s. 2d. per gal., according to quality, f.o.r. maker's works. MANCHESTER : 9½d. to 1s. per gal.

Cresylic Acid.—Pale 99%, 5s. 8d. per gal. ; 99.5/100%, 5s. 10d. American, duty free, for export, 7s. 6d. to 8s. 6d. naked at works.

Naphtha.—Solvent, 90/160°, 4s. 2½d. per gal. for 1000-gal. lots ; heavy, 90/190°, 3s. 8d. per gal. for 1000-gal. lots, d/d. Drums extra : higher prices for smaller lots.

Naphthalene.—Crude, ton lots, in sellers' bags, £18 16s. 3d. to £34 per ton according to m.p. ; hot-pressed, £50 to £60 per ton, in bulk ex works ; purified crystals, £68 10s. to £79 3s. 4d. per ton.

Pitch.—Medium, soft, home trade, 130s. per ton f.o.r. suppliers' works ; export trade, 200s. per ton f.o.b. suppliers' port. MANCHESTER : £6 10s. f.o.r.

Pyridine.—90/160°, 42s. 6d. per gal. MANCHESTER : 35s. to 40s. per gal.

Toluol.—Pure, 4s. 7½d. per gal. MANCHESTER : Pure, 4s. 7½d. per gal. naked.

Xylol.—For 1000-gal. lots, 5s. 1½d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton ; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d. per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d. to 5s. 6d. per gal. ; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediate and Dyes
(Prices Nominal)

***m*-Cresol 98/100%.**—3s. 9d. per lb. d/d.

***o*-Cresol 30/31° C.**—1s. 4d. per lb. d/d.

***p*-Cresol 34/35° C.**—3s. 9d. per lb. d/d.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb. ; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 11d. per lb.

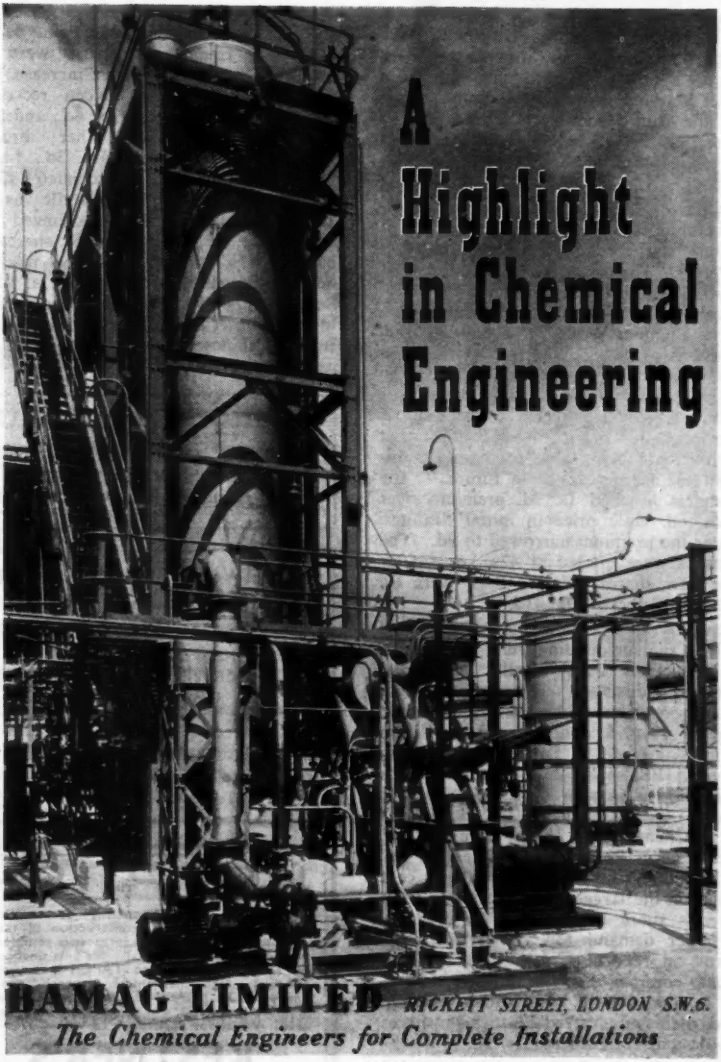
Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—1s. 2d. per lb. ; P.G. 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10-cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.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Engineering
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Chemical & Allied Stocks & Shares

STOCK markets have reflected a general tendency to await the Budget and with buyers cautious, prices, particularly in the industrial sections, again moved lower on balance, although selling has not been heavy. Markets invariably attempt to discount the future some way ahead, and it may be that the fall in industrial shares has been carried too far.

The many new issues made in recent weeks have been confined as far as industrial companies are concerned to offers of additional shares to shareholders on favourable terms. There has been a good deal of selling of some of their holdings by investors wanting cash to take up the new shares. Imperial Chemical's offer of over 10,000,000 new shares at 40s. 6d. each is one of the biggest issues made for a long time. The new shares will not rank for the past year's dividend, which is expected to be kept at 12 per cent, but the directors confirm that they anticipate being able to maintain this rate on the larger capital in future. The new shares touched 1s. 3d. premium over the 40s. 6d. issue price in initial dealings, but later the premium narrowed to 9d. The old shares were quoted at 42s. 'ex rights' to the new shares. F. W. Berk were 6s. and Boake Roberts 19s. 4½d.

Chemical shares generally have moved back with the surrounding trend of markets, though declines were mostly below the average in industrials. Fisons were 29s., Monsanto 5s. shares 25s. 6d., Eaglescliffe 5s. shares 17s. 6d. and Albright & Wilson 5s. shares 15s. 6d. Laporte were 10s., Brotherton 10s. shares 23s. 1½d., and Hardman & Holden 5s. shares 24s. 4½d. Amber Chemical 2s. shares were 2s. 6d., British Glues & Chemicals 4s. shares were 12s. 9d., and elsewhere, Borax Consolidated at 34s. were helped by the results and 10 per cent dividend on the larger capital resulting from last year's share bonus. A feature has been better demand for shares of plastic concerns on reports of increased turnover for some companies in the industry. Kleemann 1s. shares were 11s., British Xylonite 28s. 6d., British Industrial Plastics 2s. shares 5s. 10½d., and De La Rue 31s. 3d.

On the other hand, paint shares receded on news that some companies are reducing prices of their products. After firming up on the share bonus, Lewis Berger 4s. shares eased to 17s. 3d., Pinchin Johnson were 35s. 9d., and International Paint 4s. units 14s. 6d. Engineering shares were lower owing to fears of a fresh increase in the price of steel. Guest Keen receded to 48s. 6d. Staveley were 68s. 6d., and Powell Duffryn 28s. 6d. In other directions, Turner & Newall were 88s. 3d., Lever & Unilever 48s. 6d., Associated Cement 98s. 9d., and United Glass Bottle 76s. 10½d. Triplex Glass 10s. shares changed hands around 21s. 9d., Boots Drug 5s. shares came back to 19s. 6d. following the new issue news. Beecham Group were 13s. 3d., and Sangers 17s. 9d. Textiles again moved lower with Courtaulds at 39s. 3d., and British Celanese 26s. 3d. Oils, after earlier gains, receded.

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Keebush is an acid-resisting constructional material used for the construction of tanks, pumps, pipes, valves, fans, etc. It is completely inert to most commercial acids; is unaffected by temperatures up to 130°C; possesses a relatively high mechanical strength, and is unaffected by thermal shock. It is being used in most industries where acids are also being used. Write for particulars to—
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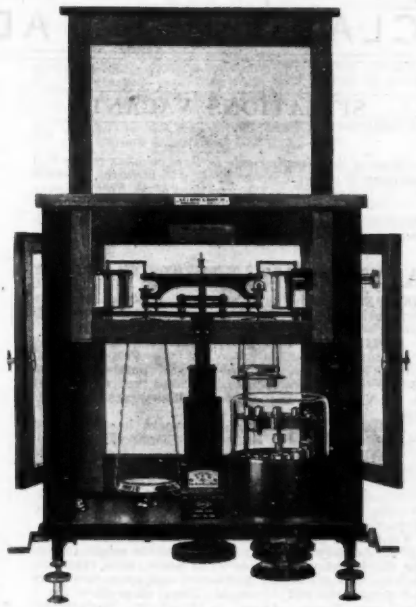

The Nivoc Automatic Aperiodic Balance

available for Immediate delivery

An automatic weight-change device has been incorporated in this instrument which represents an outstanding advance in balance design and manipulation. It consists of two circular tables, one above the other. Each table has around its perimeter, ten holes, nine of which have seatings to accommodate weights. The upper table carries the weights of 1 to 9, the lower one weights of 10 to 90 gms.

This movement is contained in a dust-proof, glass-topped housing mounted inside the balance case, providing a double safeguard against corrosion of the weights.

An important feature is that only two or three weights (in addition to the two ring weights) are used at each operation, thus reducing weight errors to a minimum.

Please write for illustrated leaflet P.1924.

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LABORATORY FURNISHERS AND MANUFACTURERS OF SCIENTIFIC APPARATUS

B30

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

None of the advertisements in these columns relates to a man aged 18-64, or a woman aged 18-59 inclusive, unless he or she is excepted from the provisions of the Notification of Vacancies Order, 1952, or the Vacancy is for employment excepted from the provisions of that Order, unless an individual advertisement indicates otherwise.

ADMIRALTY AND MINISTRY OF SUPPLY INDUSTRIAL CHEMISTS AND CHEMICAL ENGINEERS.—The Civil Service Commissioners invite applications for the following permanent and pensionable posts :—

ADMIRALTY.—Five posts in the Armament Supply Department Chemists' Pool in the Propellant and Cordite Factories at Caerwent (near Newport) and Holton Heath (near Bournemouth), and one post of Chemist in the Victualling Department at Risley (near Warrington).

MINISTRY OF SUPPLY.—25 posts in the Royal Ordnance Factories at Bridgwater, Pembrey, Bishopton, Irvine, Chorley, Swynnerton, Glascoed; in the Atomic Energy Establishments at Capenhurst and Risley; and in Headquarters Departments of the R.O.F.'s, Inspectorates and Production Directorates in the London area. Women are not eligible for posts in the Armament Supply Department of the Admiralty.

Candidates must be at least 25 and under 35 years of age on January 1st, 1952, except that the minimum age for the Ministry of Supply is 23 years, with extension for regular service in H.M. Forces, and up to two years for permanent civil servants. They must have (*a*) a University Honours Degree in Metallurgy, Engineering, Chemistry, Physics or Chemical Engineering; or (*b*) Associateship of the Royal Institute of Chemistry, the Institution of Metallurgists, or the Institute of Physics or (*c*) Corporate Membership of the Institution of Chemical Engineers; but candidates for the post in the Victualling Department of the Admiralty must possess a First or Second Class Honours Degree of a British University with Chemistry as principal subject or A.R.I.C. and have had at least two years' post-gradaute experience in one of the three main groups of stores, viz.: Provisions, Clothing, Mess Gear. Successful candidates admitted under (*a*) or (*b*) above must complete at least three years' approved experience in a factory or industrial laboratory before confirmation of appointment.

Exceptionally, candidates able to provide alternative evidence of very high professional attainments may be accepted.

Salary according to age. London rates: at 23, £375; at 25, £575; at 34, £810, then by annual increments of £30 to £900, plus a graduated pay addition. Salary scales are somewhat lower for women and for posts in the Provinces. Prospects of promotion.

Further particulars and application forms from **SECRETARY, CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, TRINIDAD HOUSE, OLD BURLINGTON STREET, LONDON, W.1,** quoting No. S.4124/52. Completed application forms must be returned by March 27th, 1952.
14751/120/FW.

CHEMIST required. Degree or H.N.C. Standard with experience in metal analysis and protective treatment preferred. Apply **PERSONNEL MANAGER, THE FAIREY AVIATION CO., LTD., HAYES, MIDDLESEX,** stating age and salary required.

DEPUTY CHIEF CHEMIST and Process Chemist wanted by expanding Chemical Firm, E. London. Salaries about £600 and £400-£500. Apply **BOX No. C.A. 3114,** THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

SITUATIONS VACANT

SALES EXECUTIVE required by Electronics Firm with International background. The principal functions are the organisation and development of sales of electronic equipment to chemical and metallurgical industry. A knowledge of these industries is more important than a knowledge of electronics. Ideal qualifications, a chemical engineer or metallurgist with at least 10 years' sales promotion experience. Substantial salary and pensionable permanency to right man. Write **BOX C.A.471, L.P.E., 110, ST. MARTIN'S LANE, W.C.2.**

SENIOR LABORATORY ASSISTANT required in Bristol factory; age 21-30 years; at least National Certificate, preferably higher qualifications; experience in paints or plastics helpful but not necessary; good prospects for right man. Apply **BOX No. C.A. 3111,** THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

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CHARCOAL, ANIMAL AND VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal-insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—**THOS. HILL-JONES, LTD., "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH, LONDON," TELPHONE 3285 EAST.**

DDT and Carrier can be ground to 250 mesh with Nedalo Screenless Mill. Write for demonstration, **CALLOW (ENGRS.), LTD., KIRKBY TRADING ESTATE, LIVERPOOL.**

GRAVITY Roller Conveyor several lengths, Rolls. 2½ in. diam. by ·16 in. 3 in. centres. Good condition. **THOMPSON & SON (MILLWALL), LIMITED, CUBA STREET, MILLWALL, E.14.** (Tel. . East 1844.)

ONE ALUMINIUM VESSEL
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9 ft. diam. × 18 ft. 3 in. high.
Vertical. ¼ in. plate.
Capacity, 8,000 gallons.
Complete with cover.
MADEN & McKEE, LTD.,
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2400 kW MOTOR GENERATOR SET suitable for electrolytic and similar processes. Makers, Metropolitan Vickers, input 3500 h.p. Synchronous motor, 11,000 volts 3 phase 50 cycles, output 3-800 kW, generators operating in parallel, output each 1600 amperes 0/500 volts, separately excited with compensating windings for stability over voltage range, speed 1000 r.p.m. Whole unit including exciters on combination baseplate. For full details with drawing apply :

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MISCELLANEOUS PROCESS PLANT

COPPER STILL, 6 ft. diam. by 6 ft. deep, on straight, with domed top and concave bottom, 18 in. diam. cover, 3½ in. diam. flange outlet. Fitted low-pressure steam coil. Fractionating column, 15 ft. by 21 in. diam., of copper construction, with 36 trays. 6 bubble caps on each tray. Condenser. of open-top shell and tube type.

3 Steam-heated **WATER STILLS** by Manesty, type 4 Capacity, 50 g.p.h. each. Steam consumption 667 lb./hr. at 20-45 lb. sq. in. 450 gals. cooling water required per hour.

M.S. Tubular CONDENSER, APPROX. 13 ft. long by 18 in. diam., fitted 84 copper tubes 1¼ in. Length of tubes, 10 ft. 3 in.

2 Steam-jacketed **ROTARY VACUUM DRYERS,** each 17 ft. 3 in. by 4 ft. 6 in. diam. Manhole in barrel with cover. Mounted on roller tracks and driven through glanded trunnion bearings. Discharge through S.J. chamber.

ROTARY DRYER, 40 ft. by 4 ft. diam. of ¼ in. M.S. plate in 5 bolted sections, on two sets trunnion rollers. Pulley drive through reduction gear. Arranged solid fuel firing from brick furnace.

TRIPLE EFFECT EVAPORATOR by E. Scott. C.I. construction. 6 ft. diam. by 11 ft. deep. Effects calandria heated, each calandria 646—2 in. o.d. by 6 ft. long, steel tubes. Complete with inter-connecting pipe work.

INFRA RED DRYING TUNNEL by Met.-Vick. Overall 26 ft. long by 3 ft. 9 in. wide by 5 ft. 5 in. high. Conveyor, 18 in. wide, for trays 25 in. by 16½ in., driven by ½ h.p. 400/3/50 geared motor. Electrical loading is 15 kW., 110V., wired in two series for 200V. single-phase and controlled by five 3-heat switches.

Selas type 9 **GAS AND AIR MIXING MACHINE.** comprising gas inlet governor, air and gas proportioning valve with Vernier adjustment, back pressure valve, booster unit, and delivery pressure controller. Maximum capacity, 25,000 cu. ft. per hr. Air/Gas mixture at adjustable delivery pressure.

BOTTLE RINSING MACHINE by Thomas & Hill. Chain conveyor type, 12 ft. centres, double row bottle fixtures 132 head. Rotary jet rinsing. Capacity, 150 dozen half or pint bottles per hour. Motorised 400/3/50.

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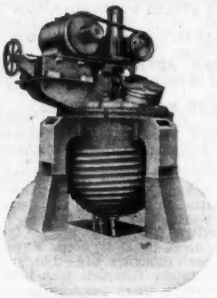

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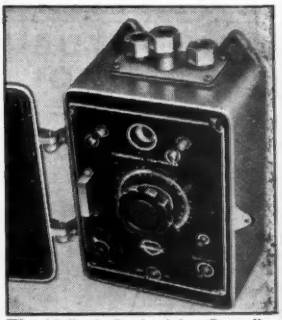

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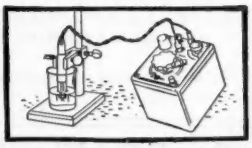

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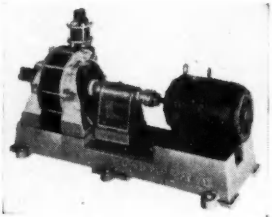

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Model A—No. 4	2"	1½"	100	107	80	44
Model A—No. 5	4"	2"	220	52	180	22

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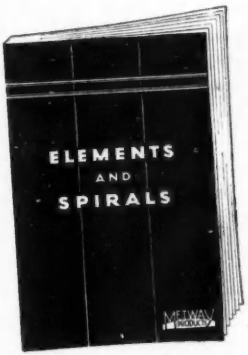

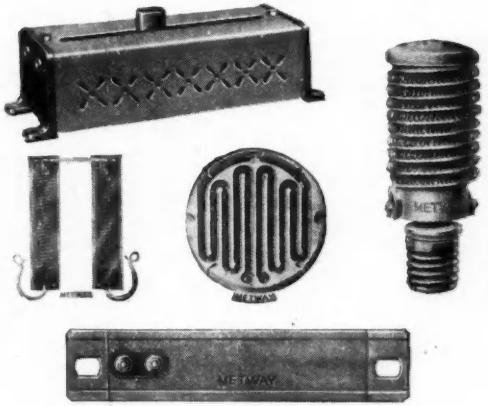

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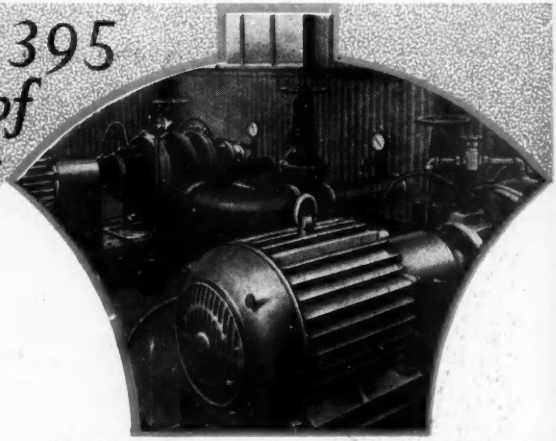
One of 395 flameproof motors for Stanlow



The photograph shows 15 h.p. totally-enclosed flameproof motors driving Sigmund pumps at the Shell Chemical plant where 195 M-V motors are installed; 200 more are installed in the Shell Oil refinery nearby.
The various types of motors used are covered by Buxton flameproof certificates and bear the FLP mark.

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